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The Research Quarterly

of the American Association for Health, Physical Education, and Recreation

MARY WIBEL, *Editor*

OCTOBER, 1949 **Volume 20, No. 3**

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A Survey of Research in the Teaching of Sports

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PURPOSE

THE purpose of this survey is two-fold: to locate research which has been done in the teaching of sports, and to focus the findings toward problems which are critical for further research. The survey and the problems brought into focus are pointed particularly toward research in vision.

The occasion for the survey is the undertaking of an extended collaborative program of research by a number of the staff members at Ohio State University, seeking to clarify the methods of teaching which are more effective for integrating training in "seeing" along with training in "doing," and more particularly with "doing" as represented in sports. This field of investigation had been opened up by Professor Hoyt Sherman of the School of Fine and Applied Arts through his development of new ways of teaching drawing by means of new ways of presenting visual stimuli (20). Soon after Professor Sherman's program had been developed for teaching drawing, the significance of the procedures for the teaching of sports became apparent. Within recent months, opportunities have been offered for analysis of teaching possibilities in sports, leading to the conclusion that the teaching of sports can be considerably improved if we can find ways of changing visual habits of our students as they are trying to learn a particular sport. As orientation for our research program, a survey of previous research was obviously desirable and is presented herewith.

SURVEY OF PREVIOUS LITERATURE

Underlying the learning of sport skills are numerous elements which have been referred to by McCloy and others as factors in motor educability. McCloy (58), in a review of various studies which have been made in this area, lists ten factors which he considers prerequisite to effective motor learning. Two of these ten concern effective vision:

"good vision," and "peripheral vision." McCloy then goes on to list sixteen more items which, while not considered as basic as the ten in his listing of prerequisites, are important considerations. Among the sixteen are three relating to vision, i.e., "sensory-motor coordination of eye with head, hand or foot," "judgment of relationship of subject to external objects," and "ability to visualize spatial relationships." Other investigators (25, 29, 33, 39) have listed still more factors in motor educability. Clearly, the factors which go into motor educability are numerous and factors relating to vision are important in the list.

Since the factors which underlie skill in sports are apparently many, it is not surprising that studies concerning the relationship between any one of these factors and ability in a particular sport have failed to establish high correlations (2, 61, 88). It appears that the "gestalt" of factors, rather than any one particular factor is the determinant of achievement in sport activities.

At this point, our first major research questions arise:

How can research on the teaching of sports be conducted so that, despite the many factors inevitably involved, the significance of any one factor, such as vision, can be sorted out? If such sorting is impossible, then how can one test the significance of any special teaching program designed to improve a specific ability?

A research program in the teaching of sports must come to a clearly defined position in relation to these questions.

Beyond the multiplicity of factors and their relationship in a gestalt, there is the further point that the gestalt for different sports is apparently different. Jones (9), in a study using factor analysis, was unable to find a general factor underlying sports ability in general, and concluded that each sport must have its own pattern of requisite abilities. Different sports depend to different degrees upon given factors, as some investigators have pointed out (2, 21, 29, 54).

Supporting the thesis of a particular gestalt for a particular sport is the daily observation of physical education teachers that individuals who excel in certain sports are commonly unable to perform effectively in others. Those outstanding in basketball, for example, may be unable to swim a stroke. Excellent swimmers may be unable to catch or bat a baseball. Excellent gymnasts may be "duffers" in golf. Occasionally, individuals are found who do possess the so-called all-round ability in sports, but they are unusual.

Reflecting on these matters raises our second set of questions:

How are we to determine the particular gestalts of ability required for each sport? Without a knowledge of these gestalts, how can we get a reasonable research control over experimentation in the teaching of any particular sport?

Is it worthwhile to attempt the development and use of tests of "general motor ability" to evaluate an individual's potentiality in various sports, or must we resort to particular tests of motor ability for the gestalt of each sport?

Does the difference in gestalts among sports mean that there is no transfer of learning from the teaching of one sport to another? Does it mean, also, that it is impossible to train for a particular ability, such as vision, without putting the training in the context of each particular sport in turn, or is it possible to provide a generalized training of vision which will be found to be effective in various sports?

Of interest to us in connection with the role of vision among factors of motor educability is a study by Bass (27) on factors related to static and dynamic balance. She found visual, kinesthetic, and tactual factors all significant in static balance. This raises the following broad question:

What factors, among all factors in motor educability, are most dependent upon vision, and in what ways are these factors affected by vision?

Bass further found that an individual uses his kinesthetic mechanism less when the eyes are open than when they are closed. This is a particularly significant point since the value of muscular "feel," or kinesthesia is recognized in the learning of motor skills. Hanley (46) emphasizes the importance of "feel" in learning golf. Griffith (43), in confirmation of Hanley's hypothesis, reports on an experiment in which blindfolded individuals were taught to drive a golf ball. In the initial weeks, their progress was comparable to a control group not using the blindfolds. After a period of several weeks, however, when the experimental group was permitted to continue their practice without the blindfolds, their progress was noticeably superior to the progress of the control group. The implications of Griffith's study are two-fold: First, it would appear that the admonition in golf to "keep your eye on the ball" is for purposes of proper body position rather than for visual reasons. Second, and in confirmation of Bass's findings, it would appear that the kinesthetic aspects of golf, particularly the swing, are more effectively learned when unaided by visual perception. When visual cues are absent, the individual is forced to rely more heavily upon kinesthetic cues. He becomes increasingly conscious of muscular "feel." Reference is made by Davis (3) to the fact that blind people have learned to play effective golf.

For the teacher of sports, this effectively forces another inquiry:

To what degree and in what ways can the visual factor be manipulated in teaching situations so as to force kinesthetic awareness and development more quickly and effectively?

An interesting study performed at the State University of Iowa showed a relationship to exist between visualization, as determined by the Thurstone test, and correct reactions on the football field under playing circumstances (12). The Thurstone test is concerned with the ability to visualize position and positional relationships. It is commonly acknowledged among coaches that the ability to see positional relationships in football is basic to effective action. Not indicated by this or other studies in physical education is whether this

ability can be developed. It appears from the work of Sherman (20) in the field of the fine arts that such abilities can be developed.

The research question for physical education is as follows:

Can the ability to see positional relationships be developed by any special type of training? If so, what methods would be used and what would be the effect in actual sports performance?

That peripheral vision is significant in certain activities is commonly recognized, and that it can be improved through training seems to be often assumed (7). But there is little research material to suggest the nature of the training to be used, or the effectiveness of such training in sports situations.

As in the case of training for positional relationships, the questions here are these:

Can peripheral vision be improved by any special type of training? If so, what methods would be used and what would be the effect in actual sports performance?

Perhaps more than any other person, Griffith (7) has attempted to point out the various functions of vision in athletics and the implications for teaching. He points out various visual illusions in respect to judgments of distance. In basketball, for example, he found errors in judgment of distance much more common than errors in judgment of direction. Both he and Davis (3) suggest that these errors can be minimized if muscular perception as well as visual perception is utilized. Griffith goes further to suggest that most motor skills are best learned the same way, i.e., by a proper integration of somatic with visual perception.

This brings forward the following basic question:

How can teaching situations be arranged so that learners are realizing visual distances in kinesthetic terms?

It is only through the ability of the body to translate visual cues into muscular language that things soon become guides to action, and the effect of this question is to raise the issue of how to get this translation done most effectively.

It is evident that one important function of the teacher of physical education is the observation and analysis of sport performance (24, 50). Without being able to see what is being done by an individual or a team, the teacher is helpless in knowing what next to do in his teaching. In such sports as football and basketball, the problem is also brought sharply into focus for coaches, scouts, sports writers, and radio reporters. One needs only to sweat it out with one of these men during an important game to know how critical is the ability to see with confidence and security.

Those who are inexperienced in the field often assume that he who knows how to play a game well will himself be a good observer

and analyst of the play of others. But such is frequently not the case. On the other hand, there are men who are not able to play a game themselves who make excellent observers and analysts.

Clearly, knowing how to observe is important, and clearly, too, the ability to observe is sufficiently independent of other performance abilities to require special treatment in its own right, if physical education teachers are to be well prepared. The research questions are:

What are the visual habits which are best for observing complex and moving configurations? Through what kind of training can these habits be developed in physical education students?

Not only for critical purposes is it necessary to see well, but for purposes of direct and positive learning. Students can learn something about how to dive by watching a diver, about how to bowl by watching a bowler, etc. Somehow we have the capacity, though in varying degrees among individuals for different activities, to "catch it by empathy." It's the capacity to feel as if one were doing a particular act when he watches another doing it. Were it not for such abilities, it is doubtful that people would come by the thousands to see athletic events. It is our capacity to feel "as if" we were the participants that gives us much of the thrill in watching sports events.

In recognition of this important means to learning, our research thought moves into this query:

What is it we are looking at when we succeed in learning most from another performer through empathy? How can this kind of seeing be improved?

Though there have been few research men who have been willing to tackle the empathy problem in sports teaching (we found none), there are several who have taken on the less dynamic problem of learning from movies where we see the shadow rather than the substance. These studies are not all in agreement as to the effect of the movies. In a study of the teaching of track skills, Cozens (35) found little evidence to support the value of visual aids in the teaching of motor skills. In conflict with this finding is that of Ruffa (63) who concluded that motion pictures proved a very significant aid in teaching track skills. The findings of Lockhart (57) support those of Ruffa. Other studies (1, 13, 16, 31) include consideration not only of movies but slides, charts, models, etc., under the general caption of visual aids.

The answer to the conflict on the value of the movies and to other problems in using visual aids probably lies in the conditions under which the visual aids are used, formulating for us this research question:

Under what conditions do visual aids prove effective in teaching sports? What kind of "aid" is given by the visual aids when properly used in the teaching of motor skills?

Moving beyond the generalized use of teaching aids, some investigators have made particular applications to particular sports situations. In the teaching of basketball, Anderson (26) ran an experiment in the teaching of shooting baskets by painting dots on the backboard to indicate the best points of contact for various rebound shots. She found these additional visual cues greatly facilitated the effectiveness of the experimental group in learning to shoot baskets. Such experiments raise these general questions:

What arrangement of visual cues in various sports situations will produce a learning which is more efficient than the learning now produced with the cues currently used? Are there any generalizations concerning the relative power of different kinds of cues which can be taken as a guide to research on various arrangements of visual cues?

Tied into the general considerations of learning from the observation of others and from various sorts of visual aids is the problem of learning through "mental practice," which is a process of trying to visualize a desired motor action without actually performing it at the moment. In an experiment involving the learning of shooting free throws in basketball, Vandell (67) found mental practice to be effective in learning a motor skill. Although the subjects in this experiment were too few to establish scientific fact, the study does raise the problem of how mental visualization can be used more effectively in general teaching. Recently, an interesting case was called to our attention in which a college student, paralyzed since early childhood in both legs and without prior opportunity to try to swim, was able to swim with a very creditable stroke on his first experience in the pool. Apparently, he had given the problem much advance mental visualization. The research problem would appear to be this:

What are the avenues by which students may be more rapidly trained in mentality visualizing motor activity as a guide to their learning?

Though our interest in this particular survey of research has centered on visual factors, and we might close here, we are continuously impressed with related problems which are to be considered concurrently with those of vision if research is to have a reasonably broad base.

One of the first to be suggested is that of auditory stimulation. Studies of auditory factors are less common than those of visual factors. Yet the most common means of instruction used is auditory in the sense that spoken instructions are auditory. There is a real question concerning the effectiveness of spoken instructions for the teaching of many motor skills. One study made in the area suggests that, in some instances at least, verbal instructions can actually impede the learning of a motor skill (62). Other than words, there is music which may be employed and which would appear to be particularly appropriate in the learning of rhythmic movements. One

study reveals that rhythmic response was more accurate when initiated with auditory rather than visual, or a combination of visual and auditory, stimuli (45). Kozman (10) deals with some of the general problems in this area, emphasizing the point that the use of music can be either good or bad, depending on how it is used. The general question would appear to be as follows:

> What are the conditions under which motor skills are most effectively learned through use of auditory stimulation? In what situations may auditory stimulation be combined with visual stimulation, and when is it best to use the two types of stimuli separately?

Suggested in connection with discussions of the potential value of music is the problem of relaxation, its character and importance. Kozman covers this point in the study just referred to. Jackson (52) takes up the problem in its negative form, i.e., in terms of fear and its attendant tensions. He found that fear caused even skilled individuals to give performances similar to a beginner's performance, jerky and uncoordinated. Hubbard (49), giving particular attention to the problem of defining the kind of relaxation which is most desired, suggests a system of mental conditioning which he refers to as "autosuggestion" which is to be used in those moments immediately prior to performance when tension tends to be particularly high.

Taking another line of attack, Stetson (65) studied the problem of tension in terms of ballistic, or free movements, versus slow, fixed movements. He concludes that free movements (in which antagonistic muscles are not employed) foster relaxation and are less fatiguing than slow, fixed movements (in which muscles are working in opposition to one another). Fulton (41) found that free, ballistic movements were not only more rapid than tense, fixed movements, but were also more accurate.

Such considerations, surrounding the problem of relaxation and tension, raise the basic problem of the dynamic pattern of energy flow in sports activities. For teaching, the research problem may be phrased as follows:

> To what degree and in what ways does learning of a sport activity depend upon the timing of the stimulation in terms of flow of the activity? What kind of dynamic flow allows the learner the most opportunities to learn, and when, within that flow, is the appropriate time for the introduction of various forms of stimulation?

One of the avenues into the study of the dynamics of motor activities is through the research done on the "whole" versus the "part" approaches to the teaching of physical education activities. The evidence in support of one method over the other is not conclusive, though the tendency is to favor the "whole" method. Shay (64) found the "whole" method more effective than the "part" method in the teaching of gymnastics. Rodgers (15) suggests the effectiveness

of teaching certain team games by the "whole" method. She points out that no attempt should be made to teach "part-game" skills until students have been exposed to the whole game, and recognize the need for these skills.

In experimenting with methods of teaching basketball to ninth-grade boys Cross (37) found the "whole" method more effective in teaching simple unitary functions, such as passing and catching, but the "whole-part" method most effective on some of the more complex functions. Critical in all such experimentation is, of course, the definition of what is taken to be "whole" and what is taken to be a "part." The leading research questions are these:

> What are the criteria which allow for the identification of "whole units" and "part units" in the teaching of sports? When the identifications are suitably made, what are the results of presenting learning situations which take the "whole" as the basic unit as contrasted to results obtained from presenting learning situations which take the "part" as the basic unit?

In another guise, the same question of what constitutes the basic unit appears again in the question of whether the informal, individual approach or the more formal, group approach is preferable in the teaching of motor skills. Both House (48) and Kulcinski (56) recommend the informal individual approach. A study by the latter indicates the informal, individual method to be the more effective. As with other such problems, the solution, however, probably centers around the answer to this question:

> Under what conditions is the use of the group method most effective in teaching sports, and under what conditions is the use of the individual method most effective in teaching sports?

SUMMARY

This brief resume of research in the teaching of sports is not complete, but salient areas have been suggested and numerous problems have been raised. Following our particular interest, we have given special attention to research relating to vision as a factor in the teaching of sports.

In general, the impression built up through study of these materials is that research has barely begun on the heart of learning and teaching problems. This is not only true with respect to the visual factor, but with relation to other factors as well.

There is sufficient development of the field, however, to create the impression that it might be possible and beneficial to undertake a serious outlining of research issues, woven together in terms of a system of thought and presented for better guidance to a balanced program of research in the field. Such a listing would doubtless make it quite plain that we cannot hope to get good research control of the field if we leave the matter of research up to the scattered individual projects of individual staff members and graduate students. A more

concerted program is needed, not only locally, but among physical education staffs the nation over.

Nor can the planning well stop at the borders of physical education staffs alone, for the critical problems penetrate deeply into other areas where the talents of research men in other fields are needed. Often the results of collaboration of research men from various fields results in a fresh approach to old and familiar problems which makes them all the more impelling to pursue. Such is the case, at any rate, in our own circumstance where entry into problems of learning and teaching through the channel of vision has opened up some fresh and quite concrete methods of manipulating teaching situations for experimental purposes.

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Effect of Smoking Upon Recuperation from Local Muscular Fatigue

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(Submitted for publication, December, 1948)

RECENTLY Willgoose (5) reported that cigarette smoking after work lessened ability to recover from local muscular fatigue, caused by repeatedly squeezing a hand dynamometer. Unfortunately, he gave the test with smoking first, and the test without smoking second, to all of his subjects. Therefore, the slightly better results obtained with the "non-smoking" test may possibly be explained as resulting from familiarization with the test, and not related to smoking at all. For this reason, it seemed worthwhile to repeat Willgoose's study under improved control conditions.

In general, a study of the effects of tobacco smoking upon physical performance presents many practical difficulties. One should take into account the amount of tobacco used, the time period during which this amount is consumed, whether smoke is inhaled into the mouth only or into the lungs, and whether cigarettes, pipes, or cigars are used. To these factors, one should add the "human" element. Subjects themselves may unconsciously affect the results by being convinced that smoking is harmless or harmful. The experimenter himself may be either prejudiced or honestly convinced regarding the possible effects of tobacco smoking and will thereby unwittingly lose impartiality of thinking so indispensable for scientific work. In addition, it should be mentioned here that commercial interests may, in certain instances, color the results obtained. Thus literature on the effects of tobacco smoking ranges from essays on morals to ambiguous or questionable physiological pronouncements. The few objective scientific reports are outnumbered by publications of non-critical compilations of questionable "data." In the present study the investigators recognized the difficulties involved, and made special efforts to eliminate psychological factors and to maintain an impartial and objective approach.

We at Springfield College insist on a "no-smoking" rule during athletic training. The reason for this is that we know of no study showing that smoking ever improved athletic ability. Yet it is hard to enforce the "no-smoking" rule because some students question the

harm of smoking and cite examples of athletes who have smoked and yet have done well in competition. An attempt to counteract this reaction by saying that if the athletes had stopped smoking they would have improved their performance is futile in a case of moderate smoking.

The difficulty in interpreting data on the effects of smoking, and the controversial nature of the issue, may be indicated by a few illustrations:

Dawson (1) states that of the 28 men who finished in a Pittsburgh marathon, 11 used tobacco and four of the first five used tobacco moderately. In this connection, it is of interest that Coté, winner of the 1948 and several other Boston marathons, smokes three cigars daily. In contrast with these observations Steinhaus and Grunderman (4), who summarized data on 1963 runners who participated in a three-mile, cross-country run at Aldershot, England, found that twice as many non-smokers finished in the first ten as did moderate smokers.

After studying the effect of cigarette smoking on cardiovascular action, Levy *et al,* (2) concluded that smoking in moderation by cardiac patients would result in no apparent harm. Largely on the basis of the personal experience of those present at a convention of the American Medical Association, this conclusion was vigorously assailed.

We cannot pass without comment on a statement made by Bøje (3), medical doctor for the Danish Olympic team in 1948. Said he:

> Although tobacco smoking is basically contradictory to the aims of training, it may be unwise to stop smoking abruptly just before serious competition. In such instances, the smoker usually becomes restless and nervous and may feel low. This state may be more deleterious to performance than a few puffs of a cigarette.

The authors quote Bøje reluctantly, because his opinion may be abused in defense of smoking. On the other hand, it is hoped that some investigators may submit this opinion to the acid test of experimentation.

In the present study, the writers followed the general outline of procedure used by Willgoose. In order to minimize learning and psychological factors, however, the order of "smoking" and "non-smoking" tests was randomized. Subjects were blindfolded, and during the "non-smoking" tests they smoked a placebo.

The experimental apparatus included a dynamometer with a reset indicator of maximal tension, clamped to a table, and a box inside of which were hidden two smoking contrivances. One consisted of a cigarette holder into which was inserted a cigarette used during the "smoking" part of the experiment. The other was the placebo, a make-believe cigarette, consisting of brass tube heated by an electric coil. Warm air passed on its way through a real ciga-

rette inserted in the tube. Two rubber tubes, each connected with one of the contrivances, passed through two holes in the front wall of the box and had identical mouthpieces attached to them. During the tests, the blindfolded subject was seated in the front of the box, the left forearm was placed on the table and only the left hand was used for squeezing the dynamometer.

EXPERIMENTAL PROCEDURE

The subjects of the study were 14 college students who were habitual smokers.

Although the procedure used was the same in general as in Willgoose's experiment, it is described here for convenience. The subject performed as follows:

1. Squeezed the hand dynamometer three preliminary times in order to determine the initial grip strength.
2. Squeezed the hand dynamometer at 10-second intervals for a period of six minutes. Readings on the dynamometer obtained at each squeeze during this and the following tests were recorded.
3. Rested for three minutes (either while smoking or not).
4. Squeezed the hand dynamometer at 10-second intervals for a period of four minutes. (This test was expected to indicate degree of recovery after rest.)
5. Rested for five minutes.
6. Squeezed the hand dynamometer three final times. (An indication was sought here of degree of final recovery.)

This sequence was repeated twice with each subject. Once, however, the subject was asked to smoke a cigarette in his usual manner during the three-minute rest period (item 3), and the other time he smoked the placebo.*

The order of smoking and non-smoking trials was randomized so that seven men took smoking tests first, while the other seven took non-smoking tests first. This randomization and the use of placebo represent the essential difference between the present study and the one reported by Willgoose.

TREATMENT OF DATA

For each series of tests for each subject, averages were computed for:

1. The three preliminary tests.
2. Each minute of the six-minute exercise period.
3. Each minute of the four-minute exercise period after rest.

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* The make-believe smoking used in this investigation was not too successful. Although prior to the experiment, cigarette smoke was drawn through the placebo contrivance so that some trace of smoke would be retained there, and one of the authors smoked a cigarette in the room close to the subject during this test, most of the subjects expressed their doubt that they were actually smoking.

TABLE I

DATA OBTAINED ON 14 MEN WITH A HAND DYNAMOMETER

(Figures are in kilograms)

	Preliminary test	*Mean for each minute of exercise*						*Mean for each minute of post-rest period*				*Final test*
		1	2	3	4	5	6	1	2	3	4	
1. Tests with smoking during rest period	48.3	43.8	42.4	41.4	40.9	40.9	40.4	46.2	42.7	42.3	41.9	48.7
2. Tests without smoking during rest period	46.9	44.1	42.1	41.4	41.9	40.6	40.1	45.0	42.0	40.6	40.5	47.3
3. First Tests *	45.9	42.9	41.3	40.5	40.0	40.0	39.2	43.8	41.2	40.3	40.4	47.3
4. Second Tests *	48.5	45.1	43.1	42.2	42.9	41.6	41.3	47.3	43.9	42.5	42.2	48.7

* Each subject was tested twice in random order, once with smoking, the other time without smoking. "First Tests" and "Second Tests" represent the data obtained during all first tests or all second tests, regardless of whether subjects smoked or not.

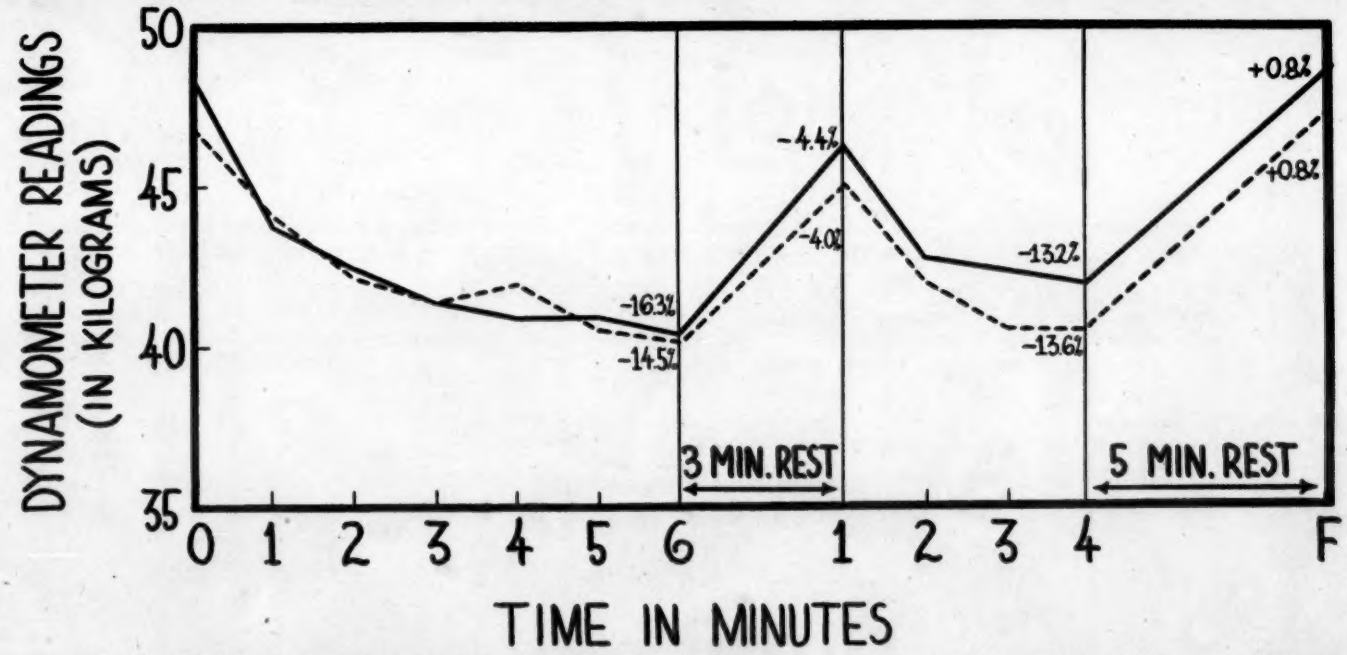

Figure 1. Effect of smoking upon recuperation from local muscular fatigue. Graph shows mean scores obtained on 14 subjects. —— Tests with smoking during the three-minute rest period. - - - Tests without smoking during the same period. O indicates preliminary tests; F indicates final tests. Percentage figures indicate increase (+) or decrease (—) with reference to initial grip strength. It is apparent that there is no significant difference in recovery from fatigue as a result of use or non-use of cigarette during rest period.

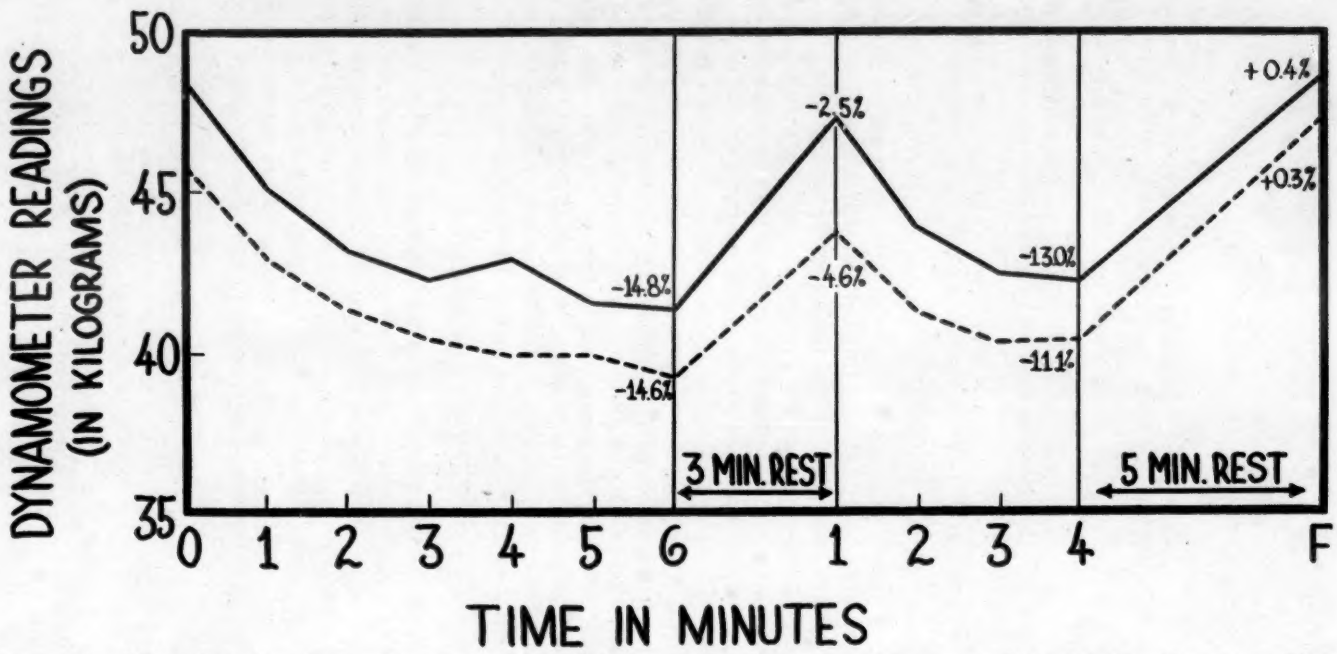

Figure 2. Effect of practice upon performance on a hand dynamometer. Graph shows mean scores obtained on 14 subjects. --- First test. —— Second test. O indicates preliminary test; F indicates final test. The percentage figures indicate increase (+), or decrease (—) with reference to initial grip strength. One may see that scores during the second test are higher and recovery after the three-minute rest slightly better than during the first test.

4. The three final tests.

These averages were then tabulated in four categories:

1. "Smoking" tests.

2. "Non-smoking" tests.

3. First tests, meaning that test which the subject had first in his series of two. This could be either "smoking" or "non-smoking."

4. Second tests.

Mean scores for all 14 subjects were calculated in each category. These means are shown in Table I.

From the same data, two graphs were also made. Figure 1 compares the effects of smoking and non-smoking, and Figure 2 compares data obtained during the first and second tests. The percentage of increase or decrease in these graphs was calculated by comparing respective points with the initial strength of the grip.

RESULTS AND CONCLUSIONS

Analysis of the data shown in Figure 1 revealed that there was no significant difference in results obtained with smoking and non-smoking. On the other hand, Figure 2 shows the effect of familiarization with the test. It may be seen that the solid line, representing the dynamometer readings obtained during the second series of tests indicates consistently higher readings than during the first series, and the degree of recovery after the three-minute rest is likewise greater.

A similar relation was obtained by Willgoose, but because all second tests were "non-smoking" ones, he erroneously concluded that it indicated the relative effects of smoking and non-smoking.

Thus, it must be concluded that the smoking of one cigarette by habitual smokers had no effect on recovery from local fatigue of the flexors of the hand.

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Study of Skill Tests in Badminton for College Women

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(Submitted by publication, October, 1948)

THIS study is a follow-up on the original badminton study of the Clear and Serve Tests devised by French and first published in the *Research Quarterly* in May, 1941.[1] The purpose of this study was to construct skill tests of footwork, wrist action, and ability to smash to supplement previously validated tests of the clear and serve; to analyze the tests statistically, and to establish a battery of skill tests in badminton.

PROCEDURE

1. Survey of published skill tests in badminton.
2. Selection of validated tests in badminton that might be used as a nucleus for a group of badminton tests.
3. Construction of skill tests in those phases of badminton in which skill tests do not exist.
4. Administration of tests to college women players.
5. Rating performance of players in a game situation.
6. Determining reliabilities of each test using the odd-even method stepped up by the Spearman-Brown Prophecy formula.
7. Establishing the best criterion score for each player.
8. Determining the validities by correlation between skill test score and the criterion score.
9. Obtaining intercorrelations of tests.
10. Selecting tests with highest validity and reliabilities and doing multiple correlations.
11. Using both statistical results and logic in drawing conclusions as to the battery or batteries being recommended.

SURVEY OF PUBLISHED SKILL TESTS IN BADMINTON

Edgren and Robinson have constructed five badminton tests for men. No results were reported; their work is entirely empirical.

[1] M. Gladys Scott, Aileen Carpenter, Esther French, and Louise Kuhl, "Achievement Examinations in Badminton," *Research Quarterly*, 12:2 (May, 1941), pp. 242-253.

The individual elements selected include serve tests, clear strokes, and smash.[2]

The New York State War Council has published "Evaluative Procedures in Physical Activity for Girls and Young Women." Badminton is included.[3]

The only validated tests of badminton skill reported in our professional literature are the French tests of the Serve and Clear. The reliability for the Serve Test, computed by the odd-even method stepped up by the Spearman-Brown Prophecy formula, was .89, computed on twenty-nine major students at the State University of Iowa. The validity of this test was found to be .66, when correlated with a criterion of tournament standings. The reliability for the Clear Test, computed by the odd-even method stepped up by the Spearman-Brown Prophecy formula, was .96 on the same twenty-nine aforementioned subjects. The validity of this test was found to be .60, when correlated with a criterion of tournament rankings.[4]

Selecting of Test Items

Selecting the Clear and Serve Tests as a nucleus, additional tests of Wrist Volley, Smash, and two footwork tests known as the Diagonal and Shuttle Tests were constructed.[5] The tests devised in this study were formulated on the basis of simplicity, that they might be easily understood by both teachers and players; on the basis of economy, both in cost and length of time to administer; and on the basis that the tests would measure those abilities considered important to success in playing the game of badminton. It was hoped that each test would be high in objectivity and that the tests would be usable as practice devices for improving skills in badminton.

Administration of Tests to College Women Players

The data were collected by administering the tests to a group of students in the department of health and physical education for women at Illinois State Normal University. The group consisted of fifty-nine students whose first or second teaching field is health and physical education. All the students enrolled in a course titled "Physical Education Activities 112" were used. Of those students whose first teaching field is physical education, forty-four were freshmen, two were sophomores, and two were juniors. Of those students

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[2] Harry D. Edgren and G. G. Robinson. *Individual Skill Tests in Physical Activities.* Chicago: The authors, 5315 Drexel Avenue, 1937, pp. 2-3.

[3] New York State War Council, "Evaluative Procedures in Physical Activity for Girls and Young Women," *New York State Physical Fitness Standards,* Office of Physical Fitness: State Education Department with the Department of Health and Physical Education Cooperating, 1944.

[4] Scott, *op. cit.,* pp. 242-253.

[5] Description of all tests is included in the appendix.

whose second field is physical education, seven were freshmen and four were sophomores.

This group was selected for use because it was known that they could be motivated to give their best efforts and to cooperate in the study. The girls were informed of the purposes of the study and that a portion of their grade in badminton would be based upon the scores made on the badminton tests that they were about to take.

These players had had no previous instruction in college in badminton, prior to enrolling in this course. Each girl received twelve hours of badminton instruction (one sixty-minute period twice a week for a period of six weeks). All the students in this study were instructed in badminton by one of the authors (Dr. Esther French).

The tests were administered during class time. The class instructor gave the directions and did the timing for all the tests. Tightly strung racquets and new shuttles were used.

Rating Performance of Players in a Game Situation

In lieu of an objective measure of playing ability in badminton, ratings were conducted during the second class period following the completion of the administration of skill tests. The playing ability of each player was rated by four judges, working independently. All players were rated on the same day.

Three of the raters are nationally rated officials and judges in from two to four sports. Three of them knew the majority of the players; the fourth knew none of the girls personally.

During the actual ratings, four players were assigned to each playing court and they were observed for a period of ten or more minutes by the four judges, working simultaneously but independently of each other. Opportunity was provided for longer observation of players whenever a judge desired it.

The players were judged according to their ability to play badminton with speed and with good footwork, using power as well as accuracy in the placement of their shots.

Human Man-to-Man Comparison

The judges had one practice period of sixty minutes to enable them to become familiar with the form to be used and to give them practice in evaluating the players by comparison with the written description of seven categories, and a human man-to-man comparison. Three individuals were pointed out by the instructor as being superior, average, and inferior in playing ability compared to the others in this group of fifty-nine players.[6]

[6] A. S. Barr, William H. Burton, and Leo J. Brueckner. *Supervision Principles and Practices in the Improvement of Instruction.* New York: D. Appleton-Century Co., 1938, pp. 453-455.

DISTRIBUTION OF CATEGORIES BASED UPON PERCENTAGES

The judges were urged to make use of all seven categories. Past experience in ratings has often indicated a tendency for over use of the middle categories. In an effort to avoid this, the attention of the judges was called to the desirability of a distribution in use of categories somewhat like the one below, based upon percentages:

TABLE I

SUGGESTED DISTRIBUTION OF CATEGORIES FOR USE OF JUDGES

Percentage of Fifty-nine Subjects	*Distribution*
Five percent "Experts"	Three players in category seven
Ten percent "Very Good"	Six players in category six
Twenty percent "Good"	Twelve players in category five
Thirty percent "Average"	Nineteen players in category four
Twenty percent "Fair"	Twelve players in category three
Ten percent "Poor"	Six players in category two
Five percent "Very Poor"	Three players in category one

ANALYSIS OF SKILL TEST DATA AND RATINGS

TABLE II

RELIABILITIES

Test No.	*Test Name*	*Number of Cases*	*Number of Trials*	*Odd-even Reliability Coefficient*	*Spearman-Brown Prophecy*
1	Serve	59	20	.343 ± .12	.511
2	Clear	59	20	.536 ± .09	.698
3	Smash	59	20	.554 ± .09	.734
4	Wrist Volley	59	4	.710 ± .07	.830
5	Diagonal *	59	4	.872 ± .03	.933
6	Shuttle *	59	4	.881 ± .03	.937

* Footwork tests.

The data from six tests were analyzed. These included the serve, clear, smash, wrist volley, diagonal footwork, and shuttle footwork tests. The reliabilities of these tests for this group of players were determined by use of the odd-even method, using Pearson Product-Moment Correlation technique, and stepping up each coefficient by the Spearman-Brown Prophecy formula (See Table II).

The Shuttle Test with a reliability of .881, stepped up to .937, has the highest reliability of the six tests for this group of players.

The Serve Test has the lowest reliability of the six tests included in this study. This reliability is .343; stepped up it is .511. The low reliability coefficient obtained from the data collected in this study on the Serve Test may be due to the inconsistency of performance of beginning players. In other words, the Serve Test may have been too difficult for this group at their stage of skill development. It is

also recognized that it may be a reflection on the odd-even method of obtaining a reliability coefficient.

TABLE III

VALIDITIES

Test No.	*Test Name*	*Validity Coefficient*
1	Serve	.411 ± .11
2	Clear	.449 ± .10
3	Smash	.135 ± .13
4	Wrist Volley	.523 ± .09
5	Diagonal *	.402 ± .11
6	Shuttle *	.424 ± .11

* Footwork tests.

The validity of each test for this group of players was determined by correlating the total score on each test with the criterion (See Table III). The criterion of playing ability used was the composite rating of the four judges. Correlation coefficient of agreement between the four judges was .756. Inspection of their ratings showed, that in the majority of cases, the variance was not greater than two categories. The combination selected for use as the criterion in this study was that of two times the rating of judge one (the instructor) plus the ratings of judges two, three, and four. The rating of the instructor was doubled because of her previous experience in rating performance of badminton players and her longer observation of the players in the class.

The reliability of .343 for the Serve Test appears to be lower than the validity of .411 of the same test. However, when the reliability coefficient of the Serve Test has been stepped up by the Spearman-Brown Prophecy formula, it exceeds the validity coefficient.

TABLE IV

INTERCORRELATIONS

Test No.	*Test Name*	*Test Numbers* 1	2	3	4	5	6
1	Serve	...	.358	.217	.259	.316	.239
2	Clear	.358	...	.318	.362	.388	.368
3	Smash	.217	.318	...	.066	.184	.340
4	Wrist Volley	.259	.362	.066	...	.092	.091
5	Diagonal *	.316	.388	.184	.092	...	.815
6	Shuttle *	.239	.368	.340	.091	.815	...

* Footwork tests.

Intercorrelations between the six tests were determined by use of the Pearson Product-Moment Correlation technique (See Table IV). Because of the high intercorrelation of .815 between the two

footwork tests, it did not seem desirable to include both, since they appeared to be measuring the same thing. The Shuttle Footwork Test was selected for retention, since it not only had higher validity and reliability coefficients, but was also somewhat easier to administer. The Smash Test was discarded from further consideration due to its low validity, and to the lack of confidence that the test administrators had in its value as a measure of the ability to smash.

TABLE V

DISTRIBUTION OF SCORES FOR FIFTY-NINE COLLEGE WOMEN

Test No.	*Test Name*	*Range*	*Mean*	*Standard Deviation*
1	Serve	7 - 60	33.78	12.3
2	Clear	22 - 85	59.63	15.0
3	Smash	34 - 90	66.98	11.9
4	Wrist Volley	23 -103	64.73	17.5
5	Diagonal *	38 - 54	45.44	3.4
6	Shuttle *	27.5- 39.5	32.39	2.4

* Footwork tests.

The Wrist Volley Test provided the widest range of scores, 23-103 (See Table V).

TABLE VI

MULTIPLE CORRELATION COEFFICIENTS AND REGRESSION EQUATIONS

Battery	*Combination*	*Multiple Correlation*	*Regression Equation* *
A	$R_{0.1246}$	$.698 \pm .067$	$X_0 = -17.681 + .085X_1 + .077X_2 + .129X_4 + .681X_6$
B	$R_{0.124}$	$.650 \pm .076$	$X_0 = 1.99 + .102X_1 + .115X_2 + .122X_4$
C	$R_{0.246}$	$.679 \pm .071$	$X_0 = -18.312 + .095X_2 + .138X_4 + .738X_6$
D	$R_{0.46}$	$.416 \pm .109$	$X_0 = -20.678 + .165X_4 + .932X_6$
E	$R_{0.24}$	$.383 \pm .112$	$X_0 = 3.233 + .140X_2 + .133X_4$

* The equation is simplified by dividing the largest number into one.

$_0$ = Criterion
$_1$ = Serve Test
$_2$ = Clear Test
$_3$ = Smash Test
$_4$ = Wrist Volley
$_5$ = Diagonal Footwork
$_6$ = Shuttle Footwork

The most advantageous combination of tests was obtained through the use of multiple correlations (See Table VI). The five combinations selected were chosen on the basis of logic and statistical evidence. The Serve Test has been retained and included in two multiple correlations in spite of its low reliability of .343 and low validity of .411 for this particular study in view of the fact that in another study (See footnote No. 1) the Serve Test yielded coefficients of .66 (Validity) and .96 (Reliability). It is known that a test does not have a reliability per se and that the same test given to more highly skilled players usually yields a higher correlation coefficient.

Glassow says, "Test elements which are to be used only as part of a battery of tests need not have as great a degree of relationship with the criterion as does an acceptable measure." [7]

Battery A, the four-test combination of the serve, clear, wrist volley, and shuttle footwork tests is recommended as the best measure of a player's ability to play badminton found for the fifty-nine college women in this study. The validity of this battery is .698 ± .067.

Battery C, the three-test combination of the clear, wrist volley, and shuttle footwork tests is recommended as the second-best measure of a player's ability to play badminton found for the fifty-nine college women in this study on the basis that it has a multiple correlation coefficient of .679 ± .071, and it has the advantage of one less test to administer. Since the Serve Test takes more time to administer than any of the other tests and adds so little to the battery as indicated by the multiple correlation, this three-test battery may be preferable in many situations.

TABLE VII

SIMPLIFIED VERSIONS OF REGRESSION EQUATIONS

Battery	*Equation*
A	1. Shuttle (#6) + .19 Wrist Volley (#4) + .12 Serve (#1) + .11 Clear (#2)
B	1. Wrist Volley (#4) + .94 Clear (#2) + .84 Serve (#1)
C	1. Shuttle (#6) + .13 Clear (#2) + .19 Wrist Volley (#4)
D	1. Shuttle (#6) + .18 Wrist Volley (#4)
E	1. Clear (#2) + .95 Wrist Volley (#4)

In order to obtain the best proportion between the tests in the batteries, and to permit the use of raw scores in combining the tests, regression equations were computed. These give the weightings of the raw scores for each test (See Table VI).

Simplified versions of these regression equations are presented in Table VII for the convenience of teachers.

CONCLUSIONS

1. Battery A, the four-test combination of the serve, clear, wrist volley, and shuttle footwork tests, is recommended as the best measure of a player's ability to play badminton found for the fifty-nine college women in this study. The validity of the battery is .698.

2. Battery C, the three-test combination of the clear, wrist volley, and shuttle footwork tests, is recommended as the second-best measure of a player's ability to play badminton found for the fifty-nine college women in this study on the basis that it has a multiple correlation coefficient of .679, and it has the advantage of one less test to administer.

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[7] Ruth B. Glassow and Marion R. Broer. *Measuring Achievement in Physical Education.* Philadelphia and London: W. B. Saunders Co., 1938, pp. 43-44.

3. Neither of the two-test batteries is recommended for the purpose of evaluation.

4. All of the tests, including the smash, appear to have value as practice devices, following instruction in badminton.

5. The Smash Test is the least valid of the six tests for this group of players with a validity coefficient of .135.

6. The Wrist Volley Test is the most valid of the six tests for this group of players with a validity coefficient of .523.

7. The Serve Test has the lowest reliability of the six tests included in this study.

8. The Diagonal Test may be substituted for the Shuttle Test.

9. With the exception of the two tests of footwork, the intercorrelation coefficients indicate that the tests are not measuring the same abilities to any great extent.

10. The two new devices for improving the rating procedure (human man-to-man comparison and suggested percentage in each category) appeared to be advantageous and well worth the time they took.

RECOMMENDATIONS

1. More study needs to be made of all of these tests in regard to number of trials, amount of time, and dimensions. Data should be collected on a large number of players and the sampling should include a wider variety of playing ability. A mechanical method for propelling the shuttle in a standardized manner is needed. A device is also needed for measuring the speed of a shuttle while in flight. The relative importance of form in executing strokes, power or speed of strokes, speed of footwork, accuracy in placement, and strategy needs to be determined, and in relation to the stage of development of the badminton player (such as beginner, intermediate, advanced, tournament player).

2. The evaluation of new tests of proven reliability might well be made against the criterion of the four-item battery recommended in this study as well as against ratings by judges.

3. The problems involved in securing an adequate criterion need continued study. Perhaps ratings should be done of each skill rather than of playing ability in general.

4. If the tests are to be used as a measure of playing ability and evaluated against a criterion of playing ability when combined into a battery, then tests which measure other elements such as competitive spirit and sense of strategy need to be devised.

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APPENDIX

I. Footwork

A. Shuttle Test

1. Equipment
   a. One stop watch
   b. Racket
2. Floor Markings (See Figure 1)

a. Use the side boundary lines (singles) and the center line of a regulation badminton court. Call one boundary line A and the opposite one C. Call the center line B.

3. Test

a. The player to be tested shall stand facing the net on a spot marked X on the side boundary line (singles), called A, at the intersection of the back doubles service court line and the side boundary line (singles) with racket in hand. On signal, he uses sliding steps in a direction parallel to the back doubles service court line to the opposite side boundary line (singles), called C, or runs and turns with a pivot (so the body will always be in position to return a shuttle sent to his forehand side) and returns to line A, moving back and forth between lines A and C for a period of fifteen seconds. The scorer, designated as Y in the diagram, shall stand anywhere between the short service line and the net with back toward net. Eight players may be tested at one time on four regulation badminton courts, a space approximately that of a regulation tennis court.

4. Scoring

a. Score one point for each crossing of lines B, C, and A. The score will be the total points of crossings for a period of fifteen seconds. (For ease in recording, count only the times lines A and C are crossed and credit one-half

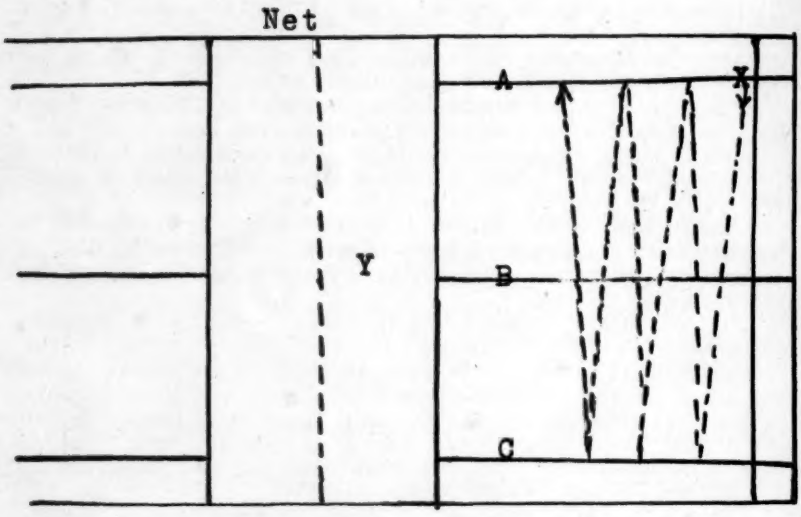

Figure 1. Path of Player in Shuttle Test.

of a point if player has reached the center line, B, at the end of fifteen seconds.) Each player is to receive four trials of fifteen seconds each. Record all the trials. The final score is the total of the four trials. The scorer and player to be tested are to alternate, assuring each of a rest period between trials.

B. Diagonal Test

1. Equipment
   a. One stop watch
   b. Racket
2. Floor Markings (See Figure 2)

a. Use the corners formed by the side boundary lines (singles) of a regulation badminton court where they intersect with the short service line and with the back line of the doubles service court. Mark an X on the center line midway between the short service line and the back line of the doubles service court.

3. Test

a. The player to be tested shall stand facing the net on a spot marked X on the center line midway between the short service line and the back doubles service court line with racket in hand. On signal, he runs diagonally right and forward to the intersection of the side boundary line (singles) and the short service line to the intersection with the opposite side boundary line (singles); turns with a pivot (so the body will always be in position to return a shuttle sent to his forehand side); runs diagonally across the starting mark, called X, to rear right to the intersection with the opposite side boundary line (singles) with the back doubles service court line; turns with a pivot and runs parallel to the back service line (doubles); turns with a pivot and runs diagonally to front right corner crossing starting mark as test is to be continued for a period of fifteen seconds. The scorer, designated as Y on the diagram, shall stand anywhere between the short service line and the net with back to net. Eight players may be tested at one time on four regulation badminton courts, a space approximately that of a regulation tennis court.

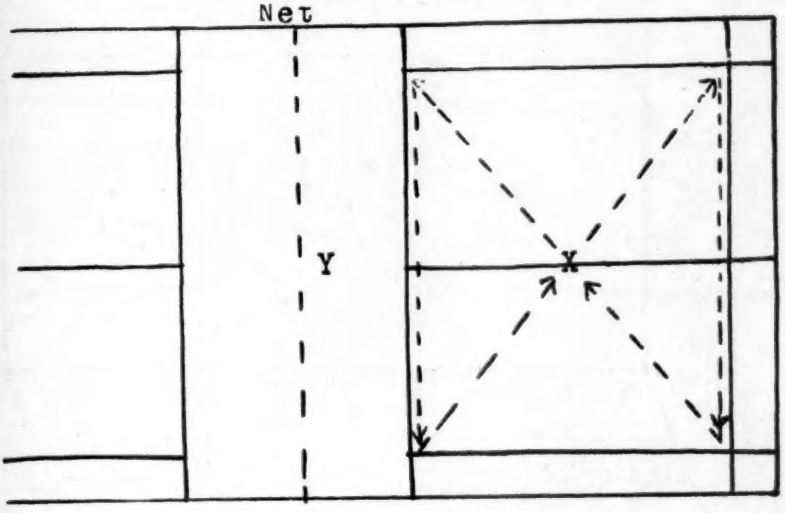

Figure 2. Path of Player in Diagonal Test.

4. Scoring.

a. Score one point for each corner and credit a point for each crossing of the starting mark, called X. The score will be the total points of corners and crossings of the starting mark for a period of fifteen seconds. Each player is to be given four trials of fifteen seconds each. Record all the trials. The final score is the total of the four trials. The scorer and player to be tested are to alternate, assuring each of a rest period between trials.

II. Wrist Power

A. Wrist-Volley Test

1. Equipment
   a. One stop watch
   b. Tightly strung badminton racket
   c. New badminton shuttle
2. Floor Markings (See Figure 3)

a. The target is an unobstructed wall of smooth brick construction with a space 12-15 feet wide continuing upward from the floor toward the ceiling to a height of at least 15 feet. A restraining line 1½ inches wide is to be drawn with white show card paint (which can be easily washed from floor) on the floor parallel to and six feet from the wall. Include the 1½ inches of the restraining line in the six-foot distance from the wall.

3. Test

a. The player to be tested shall stand behind the six-foot restraining line facing the wall with racket and shuttle in hand. On signal, he serves the shuttle with an underhand serve against the wall and volleys it on each rebound for a period of thirty seconds. Strokes made while the player is closer to the wall than the restraining line shall not count. The player may cross the restraining line to recover the shuttle, but he must return to a position behind the restraining line before putting shuttle into play again with an underhand serve. Any stroke may be used. (Hard driven forehand or backhand strokes with good wrist action seem to produce best results.) Allow a five-minute practice period before testing. The test should be demonstrated before the students practice. The scorer shall stand behind the player being tested and slightly

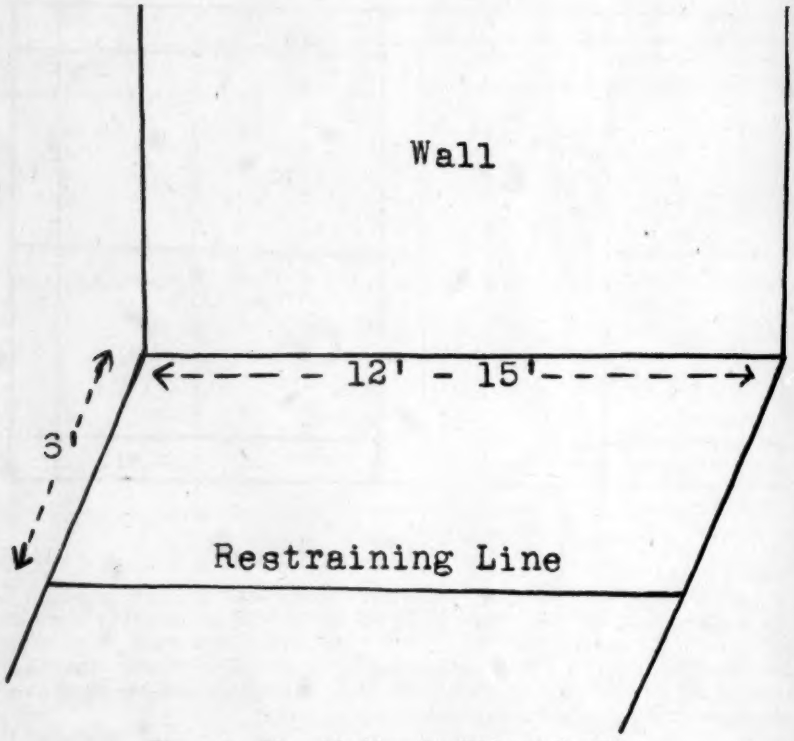

Figure 3. Floor Markings for Wrist Volley Test.

to her side. Twenty or more players can be tested at one time along four sides of a gymnasium.

4. Scoring

a. Score one point for each volley against the wall. Putting the bird into motion with an underhand serve is not considered a volley. The score is the total number of times the shuttle is volleyed against the wall in thirty seconds. Each player is to receive four trials of thirty seconds each. Record all the trials. The final score is the total of the four trials. The scorer and player to be tested are to alternate, assuring each of a rest period between trials.

III. Technique

A. Smash Test

1. Equipment

a. A clothesline rope stretched seven feet high parallel to and two feet from the net on the same side as the target

b. Tightly strung badminton racket

c. New badminton shuttles (at least five for each player being tested)

2. Floor Markings (See Figure 4)

a. Use the short service line and the back doubles service line of a regulation badminton court, also the back service line (singles). Draw two lines 1½ inches wide with show card paint (which can be easily washed from floor) parallel to and one-third and two-thirds respectively of the distance between the short service line and the back doubles service line. The lines shall be

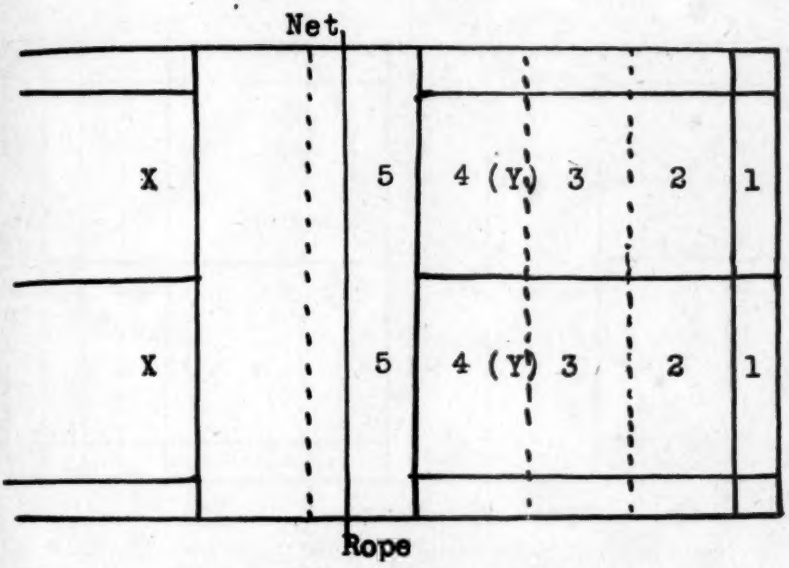

Figure 4. Floor Markings for Smash Test.

painted in different colors to increase accuracy of scoring. Number the areas of the target five, four, three, two, and one consecutively beginning with the area nearest the net through to the back service line (singles).

3. Test

a. The player to be tested, called X, shall stand anywhere behind the short service line on the court opposite the target and receive twenty shuttles (consecutively or divided into two groups of ten), which he will try to smash between the clothesline rope and the net, aiming for the area marked five on the target. The shuttles shall be served to the player being tested by an experienced player, designated as Y in the diagram, standing anywhere in the service court area, who must serve the shuttle above the clothesline rope with enough force so that it will carry back to the short service line opposite the target. If the server hits the rope, it shall be a fault. He shall serve another. The player to be tested plays only good serves, but having once touched a shuttle with a racket, that shall be considered a trial. Twenty trials shall be given. If shuttle is smashed so as to contact body of the server, scorer shall estimate the area in which it would have fallen. A shuttle smashed into the net in such a way that it crosses it and falls into the target is counted, as is true in the game. Two practice trials shall be given. The test should be demonstrated and the scorers taught to distinguish between a drop shot and a smash. The server shall act as scorer and shall call out the score of each of the twenty trials to be recorded by an assistant. One assistant can record for two players being tested at one time on a regulation badminton court. (Target includes entire court for each girl.) The area between the net and the short service line counts five points, the remaining areas count four, three, two, and one respectively counting from the short service line to the back service line (singles). Shuttles landing on a line shall be given the value of the higher area.

4. Scoring

a. Score each shuttle in accordance with the area in which the cork portion of the shuttle first hits. Record all twenty trials, including those in which the shuttle is returned above the rope instead of between the rope and the net.

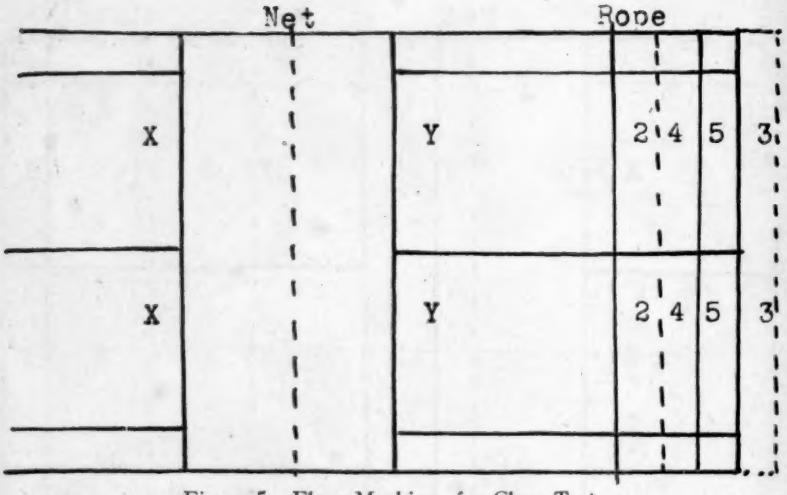

Figure 5. Floor Markings for Clear Test.

The final score shall be the total value of the twenty trials. Students shall work in groups of two, one as server and one as the player being tested and then change positions at the end of the test.

B. Clear Test[8]

1. Equipment

a. A clothesline rope stretched across the court 14 feet from the net and parallel to it at a height of eight feet from the floor on the same side as the target

b. Tightly strung badminton racket

c. New badminton shuttles (at least five for each player being tested)

2. Floor Markings (See Figure 5)

a. Construct a line 1½ inches wide with show card paint (which can be easily washed from floor) two feet nearer the net than the rear service line (doubles) and parallel to it. On the same side of the net construct a line two feet farther from the net than the rear service line (singles) and parallel to it. Measure from the exact center of the line. Extend lines from one outer alley line to the other outer line. The lines of the target shall be painted different colors to increase accuracy in scoring.

3. Test

a. The player to be tested, called X, shall stand anywhere behind the short service line on the court opposite the target and receive twenty shuttles (consecutively or divided into two groups of ten), which he will try to send by means of a clear stroke above the rope so that the shuttle lands on the target. The shuttles shall be served to the player being tested by an experienced player, designated as Y in the diagram, standing anywhere behind the short service line on the same side as the target, who must serve the shuttle with enough force that it will carry beyond the short service line opposite the target. Only shuttles played by the player being tested shall count as trials. A trial is to be considered a foul if the stroke is "carried" or "slung"[9] and shall be repeated. Two practice trials shall be given. The instructor shall demonstrate a clear stroke using good form. The server shall act as scorer and shall call out the

[8] Scott and French, *op. cit.*, pp. 51-54.

[9] For interpretation of terms, see American Badminton Association rules.

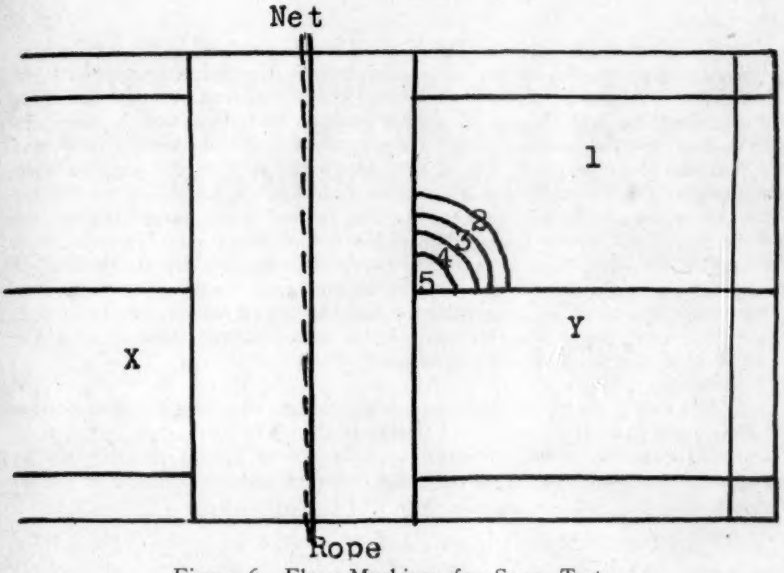

Figure 6. Floor Markings for Serve Test.

score of each of the twenty trials to be recorded by an assistant. One assistant can record for two players being tested at one time on a regulation badminton court. (Target includes entire court for each girl.) The area between the two rear lines of the regulation court counts five points, the space just behind it counts three points, and the space just in front of the two rear lines of the regulation court counts four points. Any shuttle going over the rope but failing to reach the target counts zero. Shuttles landing on a line shall be given the value of the higher area.

4. Scoring

a. Score each shuttle in accordance with the area in which the cork portion of the shuttle first hits. Record all twenty trials. The score shall be the total value of the twenty trials. Students shall work in groups of two, one as server and one as the player being tested and then change positions at end of the test.

IV. Serve

A. Serve Test [10]

1. Equipment

a. A clothesline rope stretched 20 inches directly above the net and parallel to it attached to the same standards as the net

b. Tightly strung badminton racket

c. New badminton shuttles (at least five for each player being tested)

2. Floor Markings (See Figure 6)

a. Use the intersection of the short service line and the center line as a midpoint, describe a series of arcs with show card paint (which can be easily washed from floor) 1½ inches wide in the right service court at distances of 22 inches, 30 inches, 38 inches, and 46 inches from the midpoint, measurement including the width of the 1½ inch line. Extend these arcs from the short service line to the center line. The lines of the target shall be painted different colors to increase accuracy in scoring.

[10] Scott and French, *op. cit.*, pp. 51-54.

3. Test

a. The player to be tested, called X, shall stand anywhere in the service area diagonally opposite the target and serve twenty shuttles (consecutively or divided into two groups of ten), which he will try to send through the space between the rope and the net in such a manner that they land in the right service court for the doubles game. An illegal serve is considered a fault, and the trial must be repeated.[11] The scorer, designated as Y in the diagram, shall stand nearer the center of the left service court on the same side of the net with the target and facing the target. The corner of the target nearest the intersection of the service line and center line counts five points, the next space, four points, the next, three points, then two points, and any shuttle landing off the target but in the service area for the doubles game counts one point. Any trial which fails to go between the rope and the net or which fails to land in the service court for the doubles game scores zero. Shuttles landing on a line shall be given the value of the higher area.

4. Scoring

a. Score each shuttle in accordance with the area in which the cork portion of the shuttle first hits. Record all twenty trials. The score shall be the total value of the twenty trials. Students shall work in groups of two, one as server and one as the player being tested and then change positions at end of the test.

[11] For definition of legal serve, see American Badminton Association rules.

The Development of Personnel Standards for Leadership Duties in Public Recreation

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INTRODUCTION

IN 1946, there were more men and women employed for leadership in community recreation programs, and in a larger number of cities, than ever before. The total number employed was 41,159, which represents an increase of nearly 16 percent over 1944, the highest previous year. Of the number employed, 5,147 were employed on a full-time, year-round basis. These leaders numbered 277 more than in 1944, and were reported by 148 more cities (1).

With the steady increase in the number of communities employing full-time recreation leadership, there has been an increasing need for establishing standards in the personnel qualifications to be required of those persons seeking candidacy for leadership positions in recreation. Prior to this study, sufficient standards had not been established. As a result, those responsible for hiring personnel for leadership positions in recreation had to use their own judgments as to what qualifications should be required for the various positions.

It is true that in the larger cities, personnel standards had been set up by the Civil Service Commission for the positions within the particular city concerned. However, the standards of one city differed widely from those of another. George Hjelte, general manager, Department of Recreation and Parks, Los Angeles, has pointed out this lack of standardization. In 1940 he wrote:

> Difficulties arise less from a lack of desire to appoint competent persons than from inadequate information as to what constitutes competence in this new field (2).

An intensive research study was made by Hampton (3) in analyzing business executives for leadership and other qualities. This is perhaps the most closely related work to this study. However, to the investigator's knowledge, there had been no experimental evaluation of personnel qualifications to determine standards for leadership

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An abstract of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Education, New York University, 1948.

duties in public recreation. Such an evaluation was greatly needed in order that uniform standards might be adopted by all cities.

In addition, the investigator also found a concensus among outstanding leaders in the field of public recreation that there was a great deal of overlapping in the personnel qualifications required for performing the various leadership duties. This overlapping was pointed out by Nash (4) in a report of the Committee on Play and Recreation Administration of the National Municipal League. The investigator had encountered this problem of overlapping during a previous study of community recreation (5). Therefore, there was a great need for a careful statistical analysis of the leadership duties in public recreation in order to identify overlapping in the personnel qualifications required for performing these duties.

PURPOSE OF THE STUDY

The purpose of this study was to develop standards in the qualifications required of personnel for performing the various leadership duties in public recreation, and to identify any overlapping in the personnel qualifications required for performing these duties.

This study should be a valuable contribution to the entire field of recreation. This is particularly true because of the vital role of leadership in the community recreation program. Information gathered in this study should prove valuable to those responsible for employing personnel for leadership positions in recreation. It should also be of value to those responsible for setting up training courses for recreation leadership. Finally, it should serve as a guide to those desiring to enter some phase of recreation leadership as a career.

STATEMENT OF THE PROBLEM

The problem of developing personnel standards for leadership duties in public recreation presented the need for answering four pertinent questions with their various implications:

1. What are the leadership duties in public recreation?
2. What are the personnel qualifications essential for the performance of the leadership duties in public recreation?
3. What are the interrelationships of the personnel qualifications essential for the performance of the leadership duties in public recreation?
4. In the light of the interrelationships of the essential personnel qualifications, what are the personnel standards for the leadership duties in public recreation?

SCOPE OF THE STUDY

The study included the public recreation programs of the following fifteen cities, which include all of the cities in the United States

with a population of more than 500,000, according to the 1940 census:

Baltimore, Maryland
Boston, Massachusetts
Buffalo, New York
Chicago, Illinois
Cleveland, Ohio
Detroit, Michigan
Los Angeles, California
Milwaukee, Wisconsin
New Orleans, Louisiana
New York, New York
Philadelphia, Pennsylvania
Pittsburgh, Pennsylvania
St. Louis, Missouri
San Francisco, California
Washington, D. C.

The study was limited to full-time, year-round leadership positions in public recreation and included both men and women.

PROCEDURE

In order to determine the leadership duties in public recreation, the first checklist was constructed. This checklist contained a list of full-time, year-round leadership positions in public recreation. Items for this checklist were determined by a careful study of all available literature pertaining to leadership positions in public recreation. The completed checklist was then submitted to several outstanding public recreation executives for their comments regarding its adequacy. In the light of recommendations received, the checklist was revised into final form and submitted to the public recreation department heads of the fifteen selected cities. Each department head was asked to indicate the full-time, year-round leadership positions in his department.

When the checklist was returned by all of the fifteen cities, the results were tabulated and the existing positions were listed on the second checklist. This second checklist also contained a list of leadership duties performed in the various leadership positions in public recreation. These duties were obtained from all available literature. When completed, this checklist was submitted to several outstanding public recreation executives for their recommendations. After revising the checklist in the light of recommendations received, it was submitted to the public recreation department heads of the fifteen selected cities. The department heads were asked to indicate the duties performed in the various positions by indicating whether each duty could be performed by a man only, a woman only, or either a man or woman.

When twelve of the fifteen cities had returned the second checklist, the results were tabulated and the various types of duties were classified into logical groupings of similar duties. Then the investigator prepared the third checklist. This checklist contained, in addition to the various groupings of duties, a list of ten personnel quali-

fications related to the performance of the listed duties. The investigator began with a list of twenty-nine personnel qualifications obtained from all available literature. After numerous consultations with outstanding leaders in the field of public recreation, a number of qualifications were combined and redefined, reducing the original list to ten. The checklist was then submitted to a jury of twelve experts. These experts were selected on the basis of the following criteria*:

1. Each expert had at least ten years of experience in the field of recreation.

2. Each expert held or had held a responsible position in the field of recreation.

3. The entire jury was approved by the Sponsoring Committee chairman.** The jury experts were asked to write in any additional qualifications they would require for the performance of the listed duties.

When the checklist had been returned by all of the jury experts, the list of qualifications was revised in the light of the jury's recommendations, and a fourth checklist was prepared. This checklist contained all of the information on the third checklist in a revised form. When completed, the checklist was submitted to the jury of experts. They were asked to indicate in rank order of importance the qualifications which they felt were essential for the performance of the various duties. Although all duties listed could be performed by either men or women, the jury was asked to indicate any different qualifications they would require of either sex as essential for the performance of any listed duty.

When replies had been received from all of the twelve jury experts, these replies were placed in alphabetical order. Then the average of the judgments of the first six jury experts was correlated with the average of the judgments of the remaining six, using the rank-difference correlation technique. The reliability of the twelve judgments was then estimated by using the Spearman-Brown formula (Table I). Since the reliability of the judgments of the jury experts was found to be above .9, the average ratings of the experts were accepted (Table II).

In order to determine all possible interrelationships of the personnel qualifications, the product-moment correlation technique was applied to the average ratings of the jury experts. The application of this technique revealed all intercorrelations of the qualifications for the various duties (Table III).

In an effort to determine which duties tended to cluster, a factor

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* These criteria were approved by the American Recreation Society.

** Dr. Jay B. Nash, chairman, Department of Physical Education, Health and Recreation, School of Education, New York University, was chairman of the Sponsoring Committee.

TABLE I

RELIABILITY OF JUDGMENTS OF JURY EXPERTS

Duties	*Reliability Coefficient* *
Administration of staff and volunteer personnel	.99
Administration of funds, supplies, equipment, and facilities	.99
Administration of recreation program	1.00
Supervision of staff and volunteer personnel	.99
Supervision of funds, supplies, equipment, and facilities	.99
Supervision of recreation program	.99
Organizing and conducting recreation activities	.99
Public relations	.99
Representing the department on recreation matters	1.00
Soliciting financial and legislative support for recreation	.99
Adherence to and enforcement of department regulations	.99

$$* r_{nn} = \frac{n\, r_{11}}{1 + (n\text{-}1) r_{11}}$$

Spearman-Brown Formula was used to estimate the reliability of the twelve judgments of the jury experts.

analysis of the intercorrelations was undertaken. On the assumption that the reason for a correlation is something common, the purpose was to determine the common element among duty clusters.

The Thurstone Method of Factor Analysis (6) was used in the isolation of four factors. Larson (7) had used this same technique in analyzing cardiovascular-respiratory variables and tests. The first step in this procedure involved the use of the intercorrelations (Table III). These intercorrelations were placed on an intercorrelational matrix and factor residuals were computed. Four factors were found. The original loadings and the communality for each duty are given in Table IV.

In an attempt to determine primary components, the reference axes were rotated. Four rotations were made, of which three were retained. The loadings and communality for each duty after three rotations are given in Table V. Comparisons of the communalities in this table with those of Table IV show that they have remained practically unchanged.

The results of the factor analysis of the table of intercorrelations (Table V) showed that there was no common factor, that is, a factor common to all duties. The four isolated factors were described by independent clusters of variables, which gave evidence that the personnel qualifications essential for the performance of leadership duties in public recreation were sufficiently independent or unrelated so that at least four factors were necessary to describe these duties. The four factors could not be considered entirely independent or entirely unrelated, but they were not sufficiently related for cross prediction.

TABLE II

JURY OPINION ON QUALIFICATIONS FOR LEADERSHIP DUTIES *

Duties	*Qualifications*									
	Considerateness	Courage	Health	Intelligence	Leadership	Professional Knowledge	Efficiency	Sociability	Judgment	Dependability
Administration of staff and volunteer personnel	5.4	7.3	9.1	5.7	3.6	1.9	5.8	7.0	3.5	5.8
Administration of funds, supplies, equipment, and facilities	7.8	6.1	7.8	4.5	6.3	2.7	3.0	8.0	4.5	3.6
Administration of recreation program	7.8	7.3	7.9	7.6	2.9	1.3	4.6	6.0	4.8	7.8
Supervision of staff and volunteer personnel	6.1	7.2	8.3	5.7	3.5	2.1	5.6	7.3	5.0	5.7
Supervision of funds, supplies, equipment, and facilities	5.4	6.8	8.7	4.6	6.7	4.6	3.2	7.8	3.5	3.3
Supervision of recreation program	4.9	7.9	8.6	5.0	5.0	1.9	5.9	6.1	5.0	6.7
Organizing and conducting recreation activities	6.5	8.9	9.2	5.8	3.0	2.0	4.2	5.6	3.8	5.8
Public relations	6.9	6.9	7.8	4.8	3.7	2.7	6.1	4.6	4.8	6.9
Representing the department on recreation matters	7.5	7.8	9.2	4.3	5.1	1.6	4.7	5.1	3.8	6.5
Soliciting financial and legislative support for recreation	7.7	5.3	8.2	4.1	2.8	3.8	5.3	4.3	4.6	8.7
Adherence to and enforcement of department regulations	5.9	4.3	8.3	5.3	6.8	5.5	5.3	7.0	3.0	3.4

* Each number represents the average rank given by the twelve jury experts. Ranking of 1 rated highest in importance.

In analyzing and describing the four factors, the investigator was aided by several outstanding experts in the field of public recreation.

TABLE III

INTERCORRELATIONS OF JURY RANKINGS OF PERSONNEL QUALIFICATIONS

Duties	1	2	3	4	5	6	7	8	9	10	11
2	.5709										
3	.8011	.5347									
4	.9615	.6268	.8624								
5	.5636	.8298	.2705	.5009							
6	.9101	.4754	.8007	.8818	.4609						
7	.9060	.5771	.8619	.8991	.5301	.8540					
8	.7987	.3554	.9257	.8032	.1691	.8257	.8480				
9	.8300	.6628	.8845	.8067	.5321	.8617	.8925	.8951			
10	.5527	.2002	.8277	.5533	.0045	.5406	.6169	.8574	.7084		
11	.3889	.6188	.0039	.2588	.7847	.1686	.2140	.0192	.3009	.0263	
Mean	5.51	5.43	5.50	5.65	5.46	5.70	5.48	5.52	5.56	5.48	5.48
SD	1.98	1.94	2.15	1.73	1.86	1.76	2.23	1.56	2.11	1.92	1.55

TABLE IV

ORIGINAL FACTOR LOADINGS

Duties	k_1	k_2	k_3	k_4	h^2
1	.9426	—.0168	.1871	—.2362	.9796
2	.7181	.4841	—.0719	.3819	.9010
3	.8801	—.4353	—.0182	.2532	1.0285
4	.9278	—.0781	.2611	.0501	.9376
5	.6260	.6981	.0811	.0974	.8953
6	.8791	—.1895	.2719	—.1267	.8987
7	.9266	—.1628	.1945	.0745	.9285
8	.8486	—.5177	—.1218	—.0922	1.0115
9	.9454	—.1334	—.1147	.0768	.9306
10	.6508	—.5104	—.4130	—.0476	.8569
11	.4020	.7383	—.1988	—.1476	.7680

TABLE V

ROTATED FACTOR LOADINGS

Duties	*Factor One*	*Factor Two*	*Factor Three*	*Factor Four*	h^2
1	.5681	.5932	.5169	.1949	.9798
2	.2454	.8325	—.2438	.2973	.9011
3	.8584	.2325	.1077	.4758	1.0288
4	.5595	.5368	.3657	.4504	.9378
5	—.0095	.9372	—.0101	.1294	.8952
6	.5851	.4201	.5104	.3457	.8988
7	.6374	.4711	.3239	.4423	.9287
8	.9311	.1490	.3010	.1787	1.0116
9	.7738	.5057	.1293	.2443	.9308
10	.9241	.0275	.0393	—.0279	.8569
11	—.0583	.8240	—.0696	—.2844	.7681

TABLE VI

PERSONNEL STANDARDS FOR PERSONNEL RELATIONS FACTOR *

Qualification	*Amount of Qualification*		
1. Considerateness	Ordinarily understanding and kind.	Friendly, cordial.	Goes out of his way to be considerate to others.
2. Courage	Offers moderate defense of his beliefs. Gives in when challenged strongly.	Gives in only when logically convinced.	Never gives in even in the face of the strongest opposition.
3. Health	Average mental and physical health. Emotionally stable in ordinary situations.	Better than average mental and physical health. Emotionally stable except in extreme emergencies.	Superior mental and physical health. Emotionally stable in emergency situations.
4. Intelligence	Average ability to apprehend.	Better than average ability. Bright.	Apprehends quickly and thoroughly. Brilliant.
5. Leadership	Ordinarily others are fairly responsive.	In the majority of cases he is able to activate others.	As a general rule, others manifest wholehearted response.

* Undesirable amounts indicated by shaded areas.

TABLE VI (cont.)

6. Professional Knowledge	[redacted]		
	Has a minimum of specialized knowledge necessary to perform his duties.	Has a sufficient amount of specialized knowledge necessary to perform his duties in meeting most situations.	Has full mastery of specialized knowledge necessary to perform his duties.
7. Efficiency	[redacted]	[redacted]	
	Fairly effective use of time, materials, etc., though doesn't always utilize best method.	Usually makes most effective use of time, materials, etc.	Invariably secures best results with a minimum expenditure of time, materials, etc.
8. Sociability	[redacted]		
	Usually likable.	Draws many friends to him.	Very much sought after by others.
9. Judgment	[redacted]	[redacted]	
	Uses discretion and tact in ordinary situations. Might be hasty in difficult situations.	Gives evidences of habit of using discretion and tact in most difficult situations.	Inspires unusual confidence in his soundness of judgment in all situations.
10. Dependability	[redacted]	[redacted]	
	Fairly dependable in ordinary situations.	Dependable except in very unusual situations.	Faithfully fulfills obligations without deviation.

TABLE VII

PERSONNEL STANDARDS FOR MANAGEMENT FACTOR *

Qualification	*Amount of Qualification*		
1. Considerateness	Ordinarily understanding and kind.	Friendly, cordial.	Goes out of his way to be considerate to others.
2. Courage	Offers moderate defense of his beliefs. Gives in when challenged strongly.	Gives in only when logically convinced.	Never gives in even in the face of the strongest opposition.
3. Health	Average mental and physical health. Emotionally stable in ordinary situations.	Better than average mental and physical health. Emotionally stable except in extreme emergencies.	Superior mental and physical health. Emotionally stable in emergency situations.
4. Intelligence	Average ability to apprehend.	Better than average ability. Bright.	Apprehends quickly and thoroughly. Brilliant.
5. Leadership	Ordinarily others are fairly responsive.	In the majority of cases he is able to activate others.	As a general rule, others manifest wholehearted response.

* Undesirable amounts indicated by shaded areas.

TABLE VII (cont.)

6. Professional Knowledge	[redacted]		
	Has a minimum of specialized knowledge necessary to perform his duties.	Has a sufficient amount of specialized knowledge necessary to perform his duties in meeting most situations.	Has full mastery of specialized knowledge necessary to perform his duties.
7. Efficiency	[redacted]	[redacted]	
	Fairly effective use of time, materials, etc., though doesn't always utilize best method.	Usually makes most effective use of time, materials, etc.	Invariably secures best results with a minimum expenditure of time, materials, etc.
8. Sociability	[redacted]		[redacted]
	Usually likable.	Draws many friends to him.	Very much sought after by others.
9. Judgment	[redacted]	[redacted]	
	Uses discretion and tact in ordinary situations. Might be hasty in difficult situations.	Gives evidences of habit of using discretion and tact in most difficult situations.	Inspires unusual confidence in his soundness of judgment in all situations.
10. Dependability	[redacted]	[redacted]	
	Fairly dependable in ordinary situations.	Dependable except in very unusual situations.	Faithfully fulfills obligations without deviation.

TABLE VIII

PERSONNEL STANDARDS FOR PROGRAM SUPERVISION FACTOR *

Qualification	*Amount of Qualification*		
1. Considerateness	Ordinarily understanding and kind.	Friendly, cordial.	Goes out of his way to be considerate to others.
2. Courage	Offers moderate defense of his beliefs. Gives in when challenged strongly.	Gives in only when logically convinced.	Never gives in even in the face of the strongest opposition.
3. Health	Average mental and physical health. Emotionally stable in ordinary situations.	Better than average mental and physical health. Emotionally stable except in extreme emergencies.	Superior mental and physical health. Emotionally stable in emergency situations.
4. Intelligence	Average ability to apprehend.	Better than average ability. Bright.	Apprehends quickly and thoroughly. Brilliant.
5. Leadership	Ordinarily others are fairly responsive.	In the majority of cases he is able to activate others.	As a general rule, others manifest wholehearted response.

* Undesirable amounts indicated by shaded areas.

TABLE VIII (cont.)

6. Professional Knowledge	[redacted]		
	Has a minimum of specialized knowledge necessary to perform his duties.	Has a sufficient amount of specialized knowledge necessary to perform his duties in meeting most situations.	Has full mastery of specialized knowledge necessary to perform his duties.
7. Efficiency	[redacted]	[redacted]	
	Fairly effective use of time, materials, etc., though doesn't always utilize best method.	Usually makes most effective use of time, materials, etc.	Invariably secures best results with a minimum expenditure of time, materials, etc.
8. Sociability	[redacted]		
	Usually likable.	Draws many friends to him.	Very much sought after by others.
9. Judgment	[redacted]	[redacted]	
	Uses discretion and tact in ordinary situations. Might be hasty in difficult situations.	Gives evidences of habit of using discretion and tact in most difficult situations.	Inspires unusual confidence in his soundness of judgment in all situations.
10. Dependability	[redacted]	[redacted]	
	Fairly dependable in ordinary situations.	Dependable except in very unusual situations.	Faithfully fulfills obligations without deviation.

TABLE IX

PERSONNEL STANDARDS FOR ACTIVITY LEADERSHIP FACTOR *

Qualification	*Amount of Qualification*		
1. Considerateness	Ordinarily understanding and kind.	Friendly, cordial.	Goes out of his way to be considerate to others.
2. Courage	Offers moderate defense of his beliefs. Gives in when challenged strongly.	Gives in only when logically convinced.	Never gives in even in the face of the strongest opposition.
3. Health	Average mental and physical health. Emotionally stable in ordinary situations.	Better than average mental and physical health. Emotionally stable except in extreme emergencies.	Superior mental and physical health. Emotionally stable in emergency situations.
4. Intelligence	Average ability to apprehend.	Better than average ability. Bright.	Apprehends quickly and thoroughly. Brilliant.
5. Leadership	Ordinarily others are fairly responsive.	In the majority of cases he is able to activate others.	As a general rule, others manifest wholehearted response.

* Undesirable amounts indicated by shaded areas.

TABLE IX (cont.)

6. Professional Knowledge	[redacted]		
	Has a minimum of specialized knowledge necessary to perform his duties.	Has a sufficient amount of specialized knowledge necessary to perform his duties in meeting most situations.	Has full mastery of specialized knowledge necessary to perform his duties.
7. Efficiency	[redacted]		
	Fairly effective use of time, materials, etc., though doesn't always utilize best method.	Usually makes most effective use of time, materials, etc.	Invariably secures best results with a minimum expenditure of time, materials, etc.
8. Sociability	[redacted]		
	Usually likable.	Draws many friends to him.	Very much sought after by others.
9. Judgment	[redacted]		
	Uses discretion and tact in ordinary situations. Might be hasty in difficult situations.	Gives evidences of habit of using discretion and tact in most difficult situations.	Inspires unusual confidence in his soundness of judgment in all situations.
10. Dependability	[redacted]	[redacted]	
	Fairly dependable in ordinary situations.	Dependable except in very unusual situations.	Faithfully fulfills obligations without deviation.

Using the four duty factors, the investigator constructed rating scales to rate the amount of each personnel qualification essential for the performance of each duty factor. In constructing these scales, the investigator was guided by a careful study of all available literature. Consultations were also held with outstanding experts in the fields of public recreation and psychology. When completed, each rating scale was submitted to the jury of twelve experts for their recommendations. Each rating scale was resubmitted to the jury until stabilized. When all scales had been stabilized, they were resubmitted to the jury for their ratings of the amount of each personnel qualification essential for the performance of each duty factor.

When all replies had been received from the jury, the results were tabulated. The percentage of agreement for each rating was 75 percent or above. Therefore, all ratings of the experts were accepted as standards. The ratings were then used to construct profiles for each of the four duty factors. The profiles are shown in Tables VI, VII, VIII, and IX. Each profile shows the minimum amount of each personnel qualification essential for the performance of that particular duty factor. Where it is possible to have too much of a particular qualification, the maximum amount desirable is shown on the profile. Undesirable amounts of qualifications are indicated by the shaded areas on each profile.

FINDINGS

An analysis of the data in this investigation revealed the following significant facts:

1. The following five positions, as defined, were found to be the existing full-time, year-round leadership positions in public recreation:

a. *Superintendent of Recreation:* Person in executive charge of the entire department (or bureau) of recreation.

b. *Supervisor of Playground and Community Center Activities:* Person who, under executive direction, is in responsible charge of all (or a large number of) playground and community center activities of the recreation department.

c. *Supervisor of Special Activities:* Person who, under executive direction, is in responsible charge of one or more of the following divisions of the recreation department program: athletics; music; dramatics and pageantry; beaches and swimming pool activities.

d. *Recreation Director:* Person who, under general supervision, is in responsible charge of a playground, community center, camp, swimming pool, or other recreation area or facility, or is in responsible charge of a combination of such areas or facilities.

e. *Recreation Instructor:* Person who, under general supervision, is responsible for directing one or more activities of a playground, community center, camp, swimming pool, or other recreation area or facility.

2. The leadership duties in public recreation were found to be classified as follows:

a. *Administration of Staff and Volunteer Personnel:*
   - Administer recreation staff personnel.
   - Assign duties to recreation staff personnel.
   - Maintain good relationship among recreation staff personnel.
   - Conduct periodic conferences of recreation staff personnel.
   - Organize recreation institutes for in-service training of recreation leaders.
   - Instruct recreation staff personnel in their duties and responsibilities.
   - Check vacation schedules of recreation staff personnel.
   - Assign personnel to playgrounds and community centers.
   - Study and solve personnel problems.

b. *Administration of Funds, Supplies, Equipment, and Facilities:*
   - Administer recreation facilities.
   - Allocate recreation funds in accordance with budget appropriations.
   - Arrange for use of evening recreation centers.
   - Arrange for printing of entry blanks, admission tickets, and programs.
   - Select and order prizes.
   - Prepare forms for taking attendance and inventories of equipment and supplies.
   - Set up budget for recreation activities.
   - Arrange for periodic inspections of recreation supplies and equipment.
   - Arrange for annual inventories of recreation supplies and equipment.
   - Make requisitions for recreation supplies and equipment.
   - Pass on permits for use of athletic facilities.
   - Take proper care of recreation supplies.
   - Be responsible for all monies collected.

c. *Administration of Recreation Program:*
   - Create and supervise an efficient administrative organization.
   - Choose administrative procedures.
   - Conduct studies of local conditions and needs.
   - Interpret the program to the board of directors.
   - Plan and arrange schedules for citywide events.
   - Plan celebrations, carnivals, etc.
   - Keep careful and complete records.
   - Select, adapt, and write suitable plays and pageants.

d. *Supervision of Staff and Volunteer Personnel:*
   - Supervise recreation staff personnel.

Supervise recreation institutes for in-service training of recreation leaders.
Rate recreation staff personnel.
Supervise volunteer leaders.

e. *Supervision of Funds, Supplies, Equipment, and Facilities:*
Supervise purchase of recreation supplies and equipment.
Supervise the distribution of recreation supplies and equipment.
Inspect field houses and recreation buildings.
Supervise purchase and selection of trophies.
Supervise the department costume room.
Supervise the making and distribution of costumes.

f. *Supervision of Recreation Program:*
Supervise recreation activities.
Make periodic supervisory visits to playgrounds and community centers.

g. *Organizing and Conducting Recreation Activities:*
Organize recreation activities.
Direct recreation activities.
Endeavor to have play areas used to maximum capacity.
Teach recreation activities.
Maintain proper discipline, control and supervision of those attending recreation area.
Prevent monopoly of play areas by one group.
Teach ideals of fair play, justice, loyalty, and respect for authority.
Referee and umpire games.
See that games are conducted according to rules.
Render first aid in event of accident.
Have all play areas marked off for activities such as baseball, basketball, etc.

h. *Public Relations:*
Interpret the program to the public.
Establish and maintain working relationships with local community agencies.
Arrange for informing the public regarding recreation facilities and activities.
Serve on community councils.
Address civic associations, clubs, etc.
Answer complaints concerning department activities.
Encourage participation in recreation activities.
Publicize recreation activities by newspaper, radio, signs, etc.

i. *Represent the Department on Recreation Matters:*
Serve as consultant on recreation matters.
Represent the department at local conferences.

Interview out-of-town visitors seeking information.
Represent the department on recreation matters.
Represent playground or community center at department meetings.

j. *Solicit Financial and Legislative Support for Recreation:*
Supervise fund-raising drives for recreation purposes.
Attempt to get legislative action in support of recreation.
Help raise funds during authorized drives for recreation purposes.

k. *Adherence to and Enforcement of Department Regulations:*
Attend department conferences.
Submit reports as required.
See that rules and regulations of the department are enforced.
Report all damage to recreation property.
Properly barricade dangerous equipment until necessary repairs have been made.
Refuse gratuities of any kind.
Permit only authorized concessionaires to sell or solicit in recreation areas.

3. All duties reported for any position were required for both men and women filling that position. Therefore, no sex differentiation was found in duties performed.

4. The following personnel qualifications, as defined, were selected by the jury experts as essential for the performance of all leadership duties in public recreation:

a. *Considerateness:* Extent to which one's attitude toward others shows appreciativeness, courtesy, kindliness, sympathy, unselfishness, and cooperation.

b. *Courage:* Willingness to defend one's beliefs and convictions.

c. *Health:* Mental and physical condition and emotional stability.

d. *Intelligence:* Ability to apprehend the interrelationships of presented facts in such a way as to guide action toward a desirable goal.

e. *Leadership:* Extent to which one displays initiative, enthusiasm, and the ability to influence others to follow him in thought or action.

f. *Professional Knowledge:* Knowledge of what duties should be performed in one's job and how to perform these duties.

g. *Efficiency:* Extent to which one makes effective use of time, materials, energy and space toward the accomplishment of definite aims and objectives.

h. *Sociability:* Sense of humor and ability to get along with others; extent to which one displays a live interest in people of all levels in the community.

i. *Judgment:* Use of discretion and tact in handling situations; adaptability; ability to choose clothes to "fit the occasion."

j. *Dependability:* Extent to which one is "as good as his word"; honesty; fairness based on open-mindedness or willingness to hear "both sides of the story."

5. No difference was indicated in the required personnel qualifications for either sex in the performance of any duty. Therefore, no sex differentiation was found in qualifications.

6. The reliability of the judgments of the twelve jury experts, as estimated by use of the rank-difference correlation technique and the Spearman-Brown formula, was remarkably high (Table I).

7. In nine out of the eleven leadership duties, or 82 percent, health was rated by the jury experts as the least important of the ten personnel qualifications essential for the performance of these duties (Table II).

8. In eight out of the eleven leadership duties, or 73 percent, professional knowledge was rated by the jury experts as the most important of the ten personnel qualifications essential for the performance of these duties (Table II).

9. The correlations of the jury ratings of the qualifications for the various duties range from —.004 to .96 (Table III). Some duties have much in common (high correlations), while others are rather unique.

10. The results of the factor analysis of the table of intercorrelations (Table V) prove that there is no common factor, that is, a factor common to all duties. The four isolated factors are described by independent clusters of variables, which give evidence that the personnel qualifications essential for the performance of the leadership duties in public recreation are sufficiently independent or unrelated so that at least four factors are necessary to describe these leadership duties. The four factors cannot be considered entirely unrelated, but they are not sufficiently related for cross prediction.

11. The following factors were isolated as a result of the factor analysis of the table of intercorrelations (Table V):

a. Factor I, which is identified as Personnel Relations, has relatively heavy loadings for a group of four duties: public relations, soliciting financial and legislative support for recreation, administration of the recreation program, and representing the department on recreation matters. It has relatively sizable loadings for four other duties: organizing and conducting recreation activities, supervision of the recreation program, administration of staff and volunteer personnel, and supervision of staff and volunteer personnel.

b. Factor II, which is identified as Management, has relatively heavy loadings for three duties: supervision of funds, supplies, equipment, and facilities; administration of funds, supplies, equipment, and facilities; and adherence to and enforcement of department regulations. This factor has relatively sizable loadings for five other

duties: administration of staff and volunteer personnel, supervision of staff and volunteer personnel, representing the department on recreation matters, organizing and conducting recreation activities, and supervision of the recreation program.

c. Factor III, which is identified as Program Supervision, has relatively heavy loadings for five duties: administration of staff and volunteer personnel, supervision of the recreation program, supervision of staff and volunteer personnel, organizing and conducting recreation activities, and public relations.

d. Factor IV, which is identified as Activity Leadership, has relatively heavy loadings for four duties: administration of the recreation program, supervision of staff and volunteer personnel, organizing and conducting recreation activities, and supervision of the recreation program; it has a relatively sizable loading for administration of funds, supplies, equipment, and facilities.

12. The personnel standards developed for the leadership duties identified as the Personnel Relations Factor (Table VI) show that:

a. A greater than average amount of all ten personnel qualifications is essential for the performance of these duties.

b. A superior amount of health, leadership, efficiency, judgment, and dependability is essential for the performance of these duties.

c. A superior amount of courage * is undesirable for the performance of these duties.

13. The personnel standards developed for the leadership duties identified as the Management Factor (Table VII) show that:

a. A greater than average amount of all ten personnel qualifications is essential for the performance of these duties.

b. A superior amount of health, leadership, efficiency, judgment, and dependability is essential for the performance of these duties.

c. A superior amount of considerateness, courage * and sociability is undesirable for the performance of these duties.

14. The personnel standards developed for the leadership duties identified as the Program Supervision Factor (Table VIII) show that:

a. A greater than average amount of all ten personnel qualifications is essential for the performance of these duties.

b. A superior amount of considerateness, health, leadership, efficiency, judgment, and dependability is essential for the performance of these duties.

c. A superior amount of courage is undesirable for the performance of these duties.

15. The personnel standards developed for the leadership duties identified as the Activity Leadership Factor (Table IX) show that:

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* A person possessing a superior amount of courage is one who never gives in even in the face of the strongest opposition.

a. A greater than average amount of all ten personnel qualifications is essential for the performance of these duties.

b. A superior amount of considerateness, leadership, and dependability is essential for the performance of these duties.

c. A superior amount of courage is undesirable for the performance of these duties.

CONCLUSIONS

A comparative analysis of the standard results included in Tables VI, VII, VIII, and IX reveals the following significant facts:

1. A greater-than-average amount of all ten personnel qualifications is essential for the performance of all leadership duties in public recreation.

2. A superior amount of leadership and dependability is essential for the performance of all leadership duties in public recreation.

3. A superior amount of courage is undesirable for the performance of all leadership duties in public recreation.

4. The personnel standards for the Personnel Relations Factor (Table VI) and those for the Program Supervision Factor (Table VIII) are identical except that the latter factor requires a superior amount of considerateness, whereas the former requires only a greater-than-average amount of this qualification.

5. The personnel standards for the Management Factor (Table VII) are unique in that a superior amount of considerateness and sociability is undesirable.

6. The personnel standards for the Activity Leadership Factor (Table IX) are the most unique in that only a greater-than-average amount of health, efficiency, and judgment is required.

RECOMMENDATIONS

Assuming that this investigation has revealed the true personnel standards for leadership duties in public recreation, the following recommendations are made:

1. In the selection of personnel for leadership duties in public recreation, it is recommended that the personnel standards developed in this study be used as criteria.

2. It is recommended that the personnel standards developed in this study be used by training institutions as a guide for the selection of candidates for training in recreation leadership.

3. The professional recreation societies are urged to endorse the recommended standards and encourage their widespread use in the selection and training of recreation leadership.

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Personality of Weightlifters*

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INTRODUCTION

TO one who has the problem of creating and administering physical activities, it seems important to have some understanding of why some individuals prefer, or respond to, certain types of activities while other individuals may be reached by activities of quite different types. The solution of this problem would be a large-scale project. Some progress towards this end may be achieved by examining certain of the factors involved in the elective participation of individuals in a specific activity.

In recent years, weightlifting and weight training [1] have become increasingly popular activities. The growth of participation in this type of activity has brought forth a corresponding deluge of opinions, many of them very dogmatic in regard to the merits or demerits of training with weights. Proponents and opponents have made wide claims in regard to the advantages and disadvantages, both physical and mental, of engaging in this type of activity. A review of the literature showed a lack of psychological research in this field, except for a brief paper by Henry in 1941 (3), who compared weightlifters with other groups including trackmen, and a report by Sperling in 1942 (5), who compared personality traits of varsity teams in ten activities but did not study weightlifters.

As physical director of the Oakland YMCA, the writer has watched this activity become one of the popular elements of the Oakland Association. In an effort to better understand the popularity of this program, two preliminary investigations were undertaken:

First, a questionnaire was sent to 33 physical educators who in the writer's opinion had unusually good knowledge of the weightlifting program in the YMCA. Thirty answers were received, 28 coming from men actively connected with YMCA physical education. Only two questions were asked: "What factors influence men to participate in a weightlifting program?" and "Do you think training with weights is a worthy and beneficial activity?"

* From the Research Laboratory, department of physical education, University of California, Berkeley. The writer is indebted to Dr. Franklin Henry for guidance and criticism.

[1] To those engaging in this type of activity, the term "weightlifting" denotes the competitive aspects, while weight training refers to systematic exercising with weights. In the present article the common lay usage of the term "weightlifting" to include both aspects will be followed.

Factors most predominantly mentioned in answer to the first question were: seek physical development, dislike traditional competitive sports, are concerned with health, lack self-confidence or aggressiveness, lack social confidence, desire strength. Answers to the second question showed that 27 out of 30 thought this type of activity was worthy and beneficial, but 16 of these men stipulated that the activity must be carried out under supervision.

It is interesting to quote statements of two prominent physical educators in response to the preliminary questionnaire. One of these says the influences are: desire for physical development (often to compensate for an inferiority feeling); an easy way to exercise without having to join a team, etc.; they feel that they "get their money's worth," i.e., lots of exercise in a short time; like to have something to "show off"—muscle; the girls like men strong and manly. The activity is a very good one if not pushed to excess.

The other authority states that the factors that influence men to participate are: desire for health, as they call it; joy of sport; love of their own body; compensation for a feeling of physical inferiority; feeling that a big physique is symbolic of manhood. The activity is worthy and beneficial if properly guided with an intelligent sense of balance as part of a larger, varied program.

The second preliminary investigation took the form of a personal interview with 50 weightlifters selected at random from the Oakland YMCA. These men voluntarily elected to participate in the weight training program. Again two questions were asked: "Why did you take up weight training and what did you hope to get from engaging in this activity?" and "Why do you think it is desirable to get what you hope to get from weight training?"

Forty persons definitely stated that their primary interest was to "build up" their bodies. Thirty-four of these 40 cases thought it important that they have a good body build, for the purpose of impressing or of feeling equal to other persons. Ten cases out of the 50 did not place importance on body build; instead these men wanted to "keep in shape." These individuals gave importance to feeling better and getting ahead in business through physical well being. It is interesting to note that the 40 "body build" cases had a mean age of 22.1 years while the "keep-in-shape" group showed a mean age of 35.4 years.

Out of several hundred active weightlifters in the YMCA, only about four engaged in competitive weightlifting contests. From casual observation of the more traditional physical activities of the association, this competitive proportion is very small.

The results of these preliminary studies might provide a tentative basis for the belief that weightlifters in the YMCA would be expected to differ psychologically from the remainder of the physical

activity members of the Association. The stress on body build and the use of special facilities tend to isolate the weightlifters into a readily distinguishable group. The selection of weightlifting might be influenced by a dislike of participation in the more traditional physical activities.

Since weightlifting is increasing in popularity, it might be of great interest to determine whether or not those members of the YMCA who voluntarily elect to participate in a program of weight training differ as a group in attitudes and other tendencies of personality from the rest of the active physical membership. The specific hypothesis to be examined, set up on the basis of the preliminary experiments, presumes that a dislike of competitive activity through traditional athletic games, a concern for the status of personal health, and a lack of self-confidence are important factors contributing to the choice of this activity.

METHOD

In order to discover some of the differences in attitude and personality that might exist between weightlifters and other active athletes it appeared desirable to use a technique that (1) would be simple and economical to administer, (2) could be adapted to the specific problem to be studied, (3) could be standardized so that the results might be handled easily, (4) would conceal the ultimate purpose of the test from the subjects.

It was decided to use a personality inventory; however, a review of standardized questionnaires did not reveal any that were directly suited to the specific problem at hand. An eclectic approach was used that would allow the inclusion of all areas where the experimentor thought differences might be expected to occur. The limitations of the inventory method of measuring personality were recognized (1).

Since one of the objectives of the study was to design an inventory that would be specific to the problem, a further investigation was made of existing standardized questionnaires. Certain preliminary categories were established, and items were selected from various sources and slightly reworded for consistency of form.[2] Sources were Nelson's Questionnaire (4), Henry's Interest and Attitude Inventory (3) and several standard personality inventories. The writer also designed some items that were specific to the present study.

The writer felt that men probably participated in a weight-training program either because of its attractiveness or because of a dislike of the more traditional athletic games. Questions such as, "I refuse to play certain games because I am not good at them," were designed to give some indication of attitudes toward physical activity and competition in general.

[2] A copy of the inventory is available on request to the writer.

The preliminary investigations led the writer to believe that there might be some basis for using items in regard to personal health. "As a child I was sickly," and "My health has improved in the last few years," were selected in this category.

Items were also selected with the idea that persons who elect weight training might lack self-confidence or personal aggressiveness, especially in traditional sports, and not want to compete at a loss. The clue to this reasoning came from the preliminary interviews with weightlifters in which "body build" and "want to feel equal to others" were stressed. Examples of the inventory items in this category are: "When a person makes a threat he should carry it out," and "I have complete confidence in my ability to act in a critical situation."

Henry used a questionnaire that employed items derived from a factor analysis of the Thurstone and Bernreuter questionnaires, and some items from the Allport ascendance-submission test (3). Using this questionnaire with college men, he found the items that best differentiated weightlifters from controls were numbers 1, 8, 15, 22, 28, 37, 44, 52, 58, 66, 73, and 79 of the present inventory.[3] It was felt that it would be interesting to include these items in a comparison of YMCA weightlifters with college weightlifters.

The present writer felt the inclusion of "sociability" types of items might uncover some differences in group responses. Investigation of these items will show that such traits as ascendance-submission and social introversion-extroversion, with some possible overlapping into other traits, are possibly measured. It must be remembered that all psychologists do not agree as to their proper classification.

For the purpose of general probing with the hope of uncovering some possible differences, certain miscellaneous items were added. These statements were concerned with honesty, home life, liquor, and attitudes toward women.

After some additional study in the field of personality, the writer was of the opinion that it would be advantageous to revise the name and scope of the categories. Four final categories, A, B, C, and Miscellaneous, were designated.

Category A was called "Present Health." This particular category has been described earlier in the study. Several typical items are given in Table I. The item numbers are 1, 6, 13, 20, 26, 28, 35, 42, 49, 50, 56, 63, 64, 71, 72, 77, 78, 84, 89, 93, 97, and 101.

Category B was given the title of "Self-Confidence." Preliminary investigation indicated that weightlifters might lack self-confidence in certain situations. Items such as, "I have complete confidence in my ability to act in a critical situation," "I get stage fright," and "I have difficulty starting a conversation with a stranger," are

[3] F. Henry, personal communication.

examples. Items in this group are 3, 10, 11, 15, 16, 22, 29, 33, 34, 39, 44, 45, 52, 54, 59, 68, 69, 70, 74, 75, 79, 80, 81, 83, 85, 86, 87, 88, 90, 91, 94, 95, 96, 99, 100, 102, 103, and 104.

Category C was called "Manly—Individualistic." The stress on body build and desire to feel equal to other people led to the inclusion of such items in this category as, "A well developed physique is one of the most important assets a man can have," "Men should always be the leaders in the home," and "A man should compete in team games in preference to individual sports." Items used were 2, 4, 5, 7, 8, 9, 12, 17, 18, 19, 21, 23, 24, 25, 30, 31, 32, 37, 38, 40, 41, 46, 47, 48, 51, 53 55, 57, 58, 60, 61, 62, 65, 66, 73, 76, 82, 92, 98, 105, 106, 107, and 108.

The *Miscellaneous Category* included items about borrowing property, sensitivity about inviting people to the home, using liquor, returning lost articles, and losing temper as a child (items 14, 27, 36, 43, and 67).

To disguise the purpose of the test, the inventory was labeled an "Information Poll" in order to eliminate words that might reveal the function of the test to the examinees. All 108 statements were worded so that the subjects might respond by number showing degrees of agreement, neutrality, or disagreement. A seven-point scale, as employed by Nelson (4, p. 6), was used by the examinee to indicate his response to each statement. It seemed to the writer that a seven-point scale gave greater freedom to the subject to qualify his response. It is often difficult to give a categorical "yes" or "no" answer.

The sample of men studied was obtained from the active physical membership of the Central YMCA of Oakland, California. At the time of the study approximately 2,000 men, 16 years of age or older, were enrolled in the membership. The inventory was administered to an unselected group of 100 active-member weightlifters. To establish a control group, the inventory was administered to 100 physically active members selected from other physical activities and equated to the experimental group with respect to age. The methods of selecting and equating were as follows:

A careful examination of attendance figures during the first week of October, 1948, showed participation in other physical activities by individual members in the following proportions:

Badminton	5%	Gymnastics	3%	Volleyball	10%
Basketball	35%	Handball	19%	Wrestling	4%
Boxing	7%	Swimming	17%		

Questionnaires were administered to unselected individuals in each of these activities, the number of subjects in each activity being determined by the percentage scale drawn in October. This initial control sample did not match the experimental group with respect to age distribution; consequently, where an over-abundance of cases

appeared at the particular point in the distribution, the number of questionnaires to be discarded was selected at random from the particular age category. A total of 13 inventories was removed in this fashion. The discarded inventories were replaced by giving the test to individuals selected according to age and activity, in order to equate the groups more exactly in regard to age and activity percentage.

The final experimental group showed a mean age of 25.17 years as compared to 25.21 years for the controls. Weightlifters ranged from 16 to 44 years while controls ranged from 16 to 42 years. There was no statistically significant difference in the form of the two distributions when they were compared at the point where the greatest differences in distribution occurred (chi-square = 1.078). The standard deviation of the age of the controls was 6.72; for the experimental group it was 6.30. The critical ratio of the difference was only 0.65. The two groups were also very similar as to height, weight, occupation, and education.

Because of the nature of YMCA activities, the inventory was of necessity administered almost entirely to individual subjects, never to groups larger than three persons. This helped to secure careful emphasis on the matter of sincere responses to statements. At all times the ultimate purpose of the study was withheld from the examinees.

To find the statistical significance of the difference between the two sets of data on each item, a 2 x 2 chi-square table was used (2, p.241). Yates' correction for continuity was made in all cases (2, p.247). The two groups were split at the common category that yielded a point that was nearest to 50 percent of the 200 cases. This procedure insured that error would not be incurred from very small values of "expected" frequencies.

EXPERIMENTAL RESULTS

In the present study, all inventory items have been arranged in accordance with decreasing size of P, and examined for occurrence of inversion of the theoretically expected type of differentiation between the groups. With the possible exceptions of items 13 and 95, the anticipated group responses to items (rather than inversions) were obtained to a P value of .120 (item 18). The cumulative frequency curves of expected and observed chi-square values show 25 were greater than 2.4 while only 14 would be expected if the experimental and control groups had been drawn from a common population.

To discuss each of the 25 differentiating items separately would be complicated; consequently, to make for better organization, the items were divided into categories as already explained. These categories might seem extensive in scope; however, an analysis of the item content reveals certain common elements.

All 108 test items were classified into one of these categories. The observed category frequencies in terms of values of chi-square were greater than might be expected by chance in all three principal categories. Each item is stated according to the response of the weightlifting group.

Category A (Table I) represents the weightlifters' comparative response as to their status of personal health. Item 89, "health has improved in the last few years," is very significant (chi-square 10.75—P = 0.001). It might indicate that the weightlifter in his own mind has found an activity that has done much to improve "his health," as he calls it. Since weightlifting in the YMCA is relatively new, the majority of the lifters have been lifting only a few

TABLE I

STATISTICAL SUMMARY OF THE MOST SIGNIFICANTLY DIFFERENTIATING RESPONSES TO ITEMS IN CATEGORY A (PRESENT HEALTH—22 ITEMS)*

Item No.		*Chi-Square*	*P*	*Observed*	*Expected*
89	Health has improved in the last few years	10.75	.001	1	.024
1	Feels well rested in the morning	4.88	.028	2	.57
13	Is often troubled by colds	3.07	.080	3	1.7
28	Does not feel fatigued when waking up in the morning	3.02	.081	4	1.8

* Cumulative expected frequency is based on the known probability of Chi-square as given in standard tables.

TABLE II

STATISTICAL SUMMARY OF THE MOST SIGNIFICANTLY DIFFERENTIATING RESPONSES TO ITEMS IN CATEGORY B (SELF-CONFIDENCE—38 ITEMS)*

Item No.		*Chi-Square*	*P*	*Observed*	*Expected*
79	Would probably let someone else take full responsibility for guiding a hiking party	8.96	.003	1	.11
90	Feels awkward in playing most athletic games	7.17	.007	2	.27
74	Physical education and sports programs of high schools do not satisfy most of the pupils	6.49	.011	3	.42
95	Does not find it difficult to speak in a social gathering	3.92	.047	4	1.75
81	Is often troubled with shyness	3.43	.063	5	2.55
104	Feels that he lacks self-confidence	3.38	.067	6	2.63
34	Does not have confidence to act in a critical situation	2.63	.106	7	4.08
85	Tends to brood a great deal	2.50	.113	8	4.55
59	Refuses to play certain games because he is not good at them	2.50	.113	9	4.55

* Cumulative expected frequency is based on the known probability of Chi-square as given in standard tables.

years at most. Two items indicate that the weightlifter "feels well rested in the morning" more than the non-lifter. These items show differentiation again in the direction of improved health. It must be remembered that this has not been an objective analysis of health, but simply a sampling of the attitudes of the respondents to certain questions. It could be that the objective health of the two groups is identical and that the differences in response have only a psychological basis. This concept is not limited to the health items; it applies to all items of the inventory.

In regard to item 13, the weightlifter expresses more strongly than the control, the opinion that he is often troubled by colds. This response might seem inconsistent with the other "health" items; however, it may be that the lifter may think he has fewer and less bothersome colds than *before* he took up weight training. It is not necessarily inconsistent that he feels that his "health has improved," while at the same time feeling that he has more health trouble. Both answers indicate more concern about health than is evidenced by the responses of the control group.

Category B (Table II), in the liberal use of the term, is called "self-confidence." The writer has attempted to find a common element in all of the items of the category without attempting to draw fine lines of distinction. The weightlifter "would probably let someone else take the full responsibility for guiding a hiking party" to a greater degree than the non-lifter. This item is very significant (chi-square 8.96—$P = 0.003$). The lifter's lack of desire to assume responsibility in this situation or possibly other situations is further indicated directly in such item responses as "is often troubled with shyness," "feels that he lacks self-confidence," "tends to brood a great deal," and "does not have confidence to act in a critical situation." Weightlifting is an individual type of activity that does not demand group leadership or responsibility. Acceptance by the groups in most of the traditional sports is conditioned primarily by the willingness and capability of the individual concerned to participate on a responsible basis. In this regard he "feels awkward in playing most athletic games" to a greater extent than the non-lifter and also "refuses to play certain games because he is not good at them." Participation in a weight-training program is not conditioned by the presence of highly developed motor skill. The experimental group indicates that "the physical education and sports programs of high schools do not satisfy most of the pupils." The traditional physical activity programs of high schools are of a nature that place emphasis on motor skills, a prerequisite for acceptance to many activity groups. Training with weights is not common practice in secondary schools.

In regard to item 95, the weightlifter "would not find it difficult to speak in a social gathering." This response might be considered

inconsistent with the foregoing items; however, speaking ability might have been improved as a compensation for poor motor ability.

Category C (Table III), indicates the weightlifter as compared with the control, represents himself to be more "manly" and "individualistic" in his attitude responses. Relatively he desires to be a strong and dominant individual; he would "find it a greater honor to win an individual championship than to be a member of a winning team." He also believes that "a man should not compete in team games in preference to individual sports." This finding should be expected, since training with weights is an individual type of physical

TABLE III

STATISTICAL SUMMARY OF THE MOST SIGNIFICANTLY DIFFERENTIATING RESPONSES TO ITEMS IN CATEGORY C (MANLY-INDIVIDUALISTIC—43 ITEMS)*

Item No.		*Chi-Square*	*P*	*Observed*	*Expected*
98	It is a greater honor to win an individual championship than to be a member of a winning team	10.94	.001	1	.043
105	A strong body is the best sign of good health	6.53	.011	2	.47
53	A well-developed physique is a good indication of how strong a person is	5.80	.017	3	.69
65	A man should not always be polite to a woman	5.13	.024	4	.98
30	A man should not compete in team games in preference to individual sports	4.54	.035	5	1.60
58	Treats a domineering person the same as he treats him	4.51	.036	6	1.71
108	Easy for him to turn down unreasonable requests	3.94	.048	7	2.10
61	Men should always be the leaders in the home	3.40	.065	8	3.05
25	A person should always carry out a threat	2.66	.104	9	5.00
106	Winning is the most important factor in playing a game	2.47	.118	10	5.70
8	Limits friendships mostly to own sex	2.45	.120	11	5.75
18	Could not be happy living alone in a cabin in the woods or mountains	2.45	.120	12	5.80

* Cumulative expected frequency is based on the known probability of Chi-square as given in standard tables.

activity. It might seem reasonable to interpret this preference as an indication of the desire to be a strong individual, yet not having to endure frustrations as a responsible member of a team. This inter-

pretation could be further substantiated by the differentiation shown by item 105, "a strong body is the best sign of good health," and item 53, "a well-developed physique is a good indicator of how strong a person is."

The relatively greater wish for a strong body might account for the weightlifter's inclination to be a dominant person. In preliminary interviews it was found that the desire to "feel equal" or to "impress others" was a predominant reason for wanting a good physique. This need for dominance is further demonstrated in such statements as "treats a domineering person the same as he treats him," "easy for him to turn down unreasonable requests," "a person should carry out a threat," and "winning is the most important factor in playing a game."

The lifter makes an interesting response when he "limits friendships mostly to own sex" more than the non-lifter. This would show that the lifter finds greater satisfaction in associating with men. That he desires a well developed physique indicates his desire to emulate men, i.e., to be more "manly." In his effort to be more of a man he considers women to be less equal. In reference to item 61 he believes "men should always be the leaders in the home," and to item 65, "a man should not always be polite to a woman." That he "could not be happy living alone in a cabin in the woods or mountains," might again point out his desire to be with, and resemble, other people. It would be very worthwhile to ascertain by additional study the reasons behind this desire to emulate men. A study of the home life, with emphasis on the attitude of the son toward the father, might prove very interesting.

The *Miscellaneous Category,* which included only 5 items, did not yield any significant differences in group responses.

DISCUSSION

It appears that the weightlifters in the Oakland YMCA do show group differentiation from the non-weightlifters. The differences are comparable to those found by Henry in college students (3) plus of course additional differences revealed by the added items of the present study. Basically the YMCA weightlifter would appear more shy, lacking in self-confidence, and more concerned with body build. On the other hand the lifting group wants to be strong, healthy, and dominant, to be more like other men. It seems that the weightlifter has the opportunity to participate in a physical activity that is agreeable and pleasing to him. The weightlifter is almost assured of success, with respect to developing strength and size of muscle, by devoting adequate time to the activity. Participation in the more traditional group physical activities, it appears, might be distasteful and frustrating. Since weightlifters form a rather atypical group, the voluntary selection of this activity may be psychologically beneficial.

It would be important to make a longitudinal study to determine the influence of weightlifting participation with respect to improving the individual's psychological adjustment.

The physiological effects of weight lifting, beneficial or deleterious, have not been investigated in this study; however they would have to be considered in a total evaluation.

SUMMARY AND CONCLUSIONS

In this study an inventory was administered to 100 Oakland YMCA male weightlifters and to 100 other YMCA male athletes (non-weightlifters) in an effort to determine group differences in attitudes and dispositions of personality. To find the statistical significance of differences in response between the two sets of data on each questionnaire item, the chi-square test was applied to 2 x 2 tables derived from rating-scale scores. Curves were plotted from the observed and theoretical (or chance) cumulative frequencies of the chi-squares yielded by the most significantly differentiating items.

The selected test items were classified into broad categories for the purpose of discussion. Each of the 108 inventory items was placed in one of these categories. Statistically significant differences between weightlifters and controls were found in all categories: present health, self-confidence, manly-individualistic.

Objectively the study shows only differences in responses of the two groups to specific inventory items; however an analysis of the data leads the writer to several other suggestive conclusions:

1. Training with weights probably appeals to a group that differs with respect to interests, attitudes, and personality from the rest of the active YMCA membership.

2. A logical classification of the differentiating items indicates that the members of the weightlifting group feel more strongly than the controls that their health has improved, that basically they are shy, that they lack self-confidence, and that they do not obtain satisfaction, through participating at a loss, in the more traditional physical activities. They want to be strong and dominant, emulating other strong men.

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Selection of Men Students for Professional Training In Physical Education

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THE purpose of this study was to determine and clarify the present status of selection of men students for professional training in physical education. To accomplish this purpose, efforts were directed toward discovering the prevailing practices in selection in this field and the extent to which they were representative of selection practices in general. The study was conducted during 1946 and 1947 and included a review of the development of selection in both general education and physical education, a study of the catalogs of schools offering majors in physical education for men, a survey of the procedures now in effect, an investigation of some established selection programs, and a critical review of procedures by a group of recognized authorities.

This survey and appraisal of current practices was made to discover the extent to which scientific selection procedures were being used, the implied advantages and disadvantages of the different procedures, and the probable usefulness of the various procedures as determined from the opinions of administrators. On the basis of these data, an effort was made to show wherein changes might be made and further investigation might be undertaken to provide more effective selection of men for training in physical education. Such recommendations were made as seemed to be warranted from interpretation of these data.

CATALOG STUDY

Catalogs of 227 schools listed by the American Association for Health, Physical Education, and Recreation as offering a four-year curriculum in physical education were obtained in 1946 for the purpose of analyzing selection procedures. Although the use of college bulletins is limited by the fact that published statements are not always valid indications of actual practices, such use seemed justified as these catalogs represent one of the few available sources of data on admission and retention.

An abstract of a thesis submitted in partial fulfillment of the requirement for the degree of doctor of education in the School of Education, Syracuse University, 1948.

Choice of the major in physical education was required in the freshman year in 75 percent of the schools, at the beginning of the junior year in 17 percent, and in the sophomore year in two percent. Dual enrollment in a general college and a department or school of education was the practice in six percent.

Pre-Admission Selection Procedures.—Standard admission requirements in all of the 227 schools were an official application blank, graduation from an accredited high school, and an official transcript of previous educational work. Specific numbers of high school units were required by 72 percent of the schools. Of this group 62 percent required 15 units for admission and ten percent required 16 units.

Specific high school subjects were required by 66 percent of the schools; English, mathematics, social studies and science, in that order, were most commonly listed. Physical education was mentioned by four schools. In several states there was a standard list of subjects; and where no specific subjects were listed, in many instances there were definite recommendations of subjects that should have been taken prior to college entrance.

Recommendations of the high school principal were required by 54 percent of the schools, statements of good moral character were required by 40 percent of the schools, and personality ratings by the high school principal or others were required by 23 percent. A specific high school rank or average was required for admission by 13 percent, and recent indications are that this requirement is increasing due to the greatly increased enrollments of the past three years. Minimum age requirements of 16 years were listed by ten percent of the schools, primarily the state schools and teachers' colleges.

Classification Tests.—Medical examinations were required at or prior to the time of admission by 89 percent of the schools studied. Specialized medical requirements including such items as Mantoux and Wassermann tests, chest x-rays, and a complete annual re-check of physical education majors were listed by 14 percent.

Classification tests were listed in the catalogs of 26 percent of the schools. These tests were given at the time of admission or at intervals during the training period. General batteries of tests were listed by 37 percent of the schools. In all, a total of 63 percent of the schools required some type of classification tests.

Most of the catalogs emphasized the fact that, although these tests were required, in many cases they were used for guidance rather than for the actual selection of prospective students or elimination of students in training. This situation was particularly true in the larger schools, and the schools represented in the 37 percent of those requiring a general battery of tests.

General Selection Procedures.—Personal interviews for admission or for screening of applicants were required in 11 percent of the

schools studied. Twenty-six percent of this group required attendance at pre-enrollment orientation programs and three percent required specialized courses in orientation for major students in physical education. A minimum scholarship requirement was listed or implied by most schools for continuing in the program. Twenty percent listed specific grade averages in the catalogs.

CHECKLIST STUDY

A checklist was developed to be sent to the 227 schools previously studied. The purpose of the checklist was to determine selection procedures in use through direct contact with the administrators in departments and schools offering four-year majors in physical education.

Replies were received from 141 schools (62 percent of the total contacted). Seventy-four percent of them required selection of the major at the beginning of the freshman year, 12 percent, in the sophomore year, 13 percent, in the junior year, and one percent had a dual enrollment system.

Selection procedures were used largely at the time of entrance, 128 schools (91 percent) signifying the use of specific selection procedures at this time. Twenty-one used further means of selection upon entrance to the school or college of education, 29 upon entrance to the department or school of physical education, and 15, at the time of application for practice teaching. Thus a total of 46 percent listed selection procedures in addition to those in effect at the time of entrance.

Pre-Professional Selection Procedures.—Official application or personal history blanks were required by 91 percent of the schools replying. Letters of recommendation were required from the high school principal in 50 percent of the schools. Personality ratings were required by 30 percent of the schools replying.

Graduation from an accredited high school was checked by all but one of the schools, and an official transcript of credits was listed by all. Ninety percent of the schools required a definite number of high school units for admission, and of this number 78 percent required 15 units. Specific high school courses were required for admission by 48 percent of the schools replying. Specific high school averages were required for admission by 21 percent of the schools, and a designated rank in high school was required in an additional 20 percent.

Nine percent of the administrators indicated that participation in high school sports was required for admission. Twelve percent indicated sports participation in the training program as a requirement. Three percent of the schools required participation in student affairs in high school for admission to the teacher-training program and two percent required participation in student affairs in the teacher-training program.

Classification Tests Used in Selection.—Medical examinations were required at the time of admission in all but one school. Nine percent signified that additional medical examinations were required later in the program to supplement the entrance examinations.

Mental, intelligence, or psychological tests were required at entrance in 48 percent of the schools and in eight percent later in the program. English placement tests were required by 50 percent of the schools at entrance. Contemporary affairs tests were required at admission by 11 percent. General culture tests were required by 12 percent at entrance. Speech or voice tests were required at entrance by 10 percent of the schools.

Interest tests were required at entrance by 13 percent of the schools. Personality tests were required at entrance by 12 percent. Physical skill or ability tests were required by six percent of the schools at entrance and by 10 percent later in the program. Physical education information tests were required by two percent of the schools at entrance and by seven percent later in the program.

General Selection Procedures.—Personal interviews were required at the time of entrance in 35 percent of the schools studied and later in the program in 19 percent of the schools. College scholarship standards were set in most cases by general college rules. In most cases the average for continuing in the program was reported as C or the equivalent. Orientation programs were reported in 20 percent of the schools at time of entrance. Courses in orientation to physical education were required by 8 percent of the schools replying.

OPINIONS OF EDUCATORS

An outline of selection practices and procedures was prepared and submitted to recognized authorities in physical education and general education for critical review. The list was submitted to a group selected according to training, experience, professional status or prominence in the field, and interest in selection.

The educators were chosen from four different areas. Ten were outstanding administrators and specialists in general professional fields of education, ten were men who have been concerned with the problems of student selection in general professional education, ten were outstanding administrators in men's physical education, and ten were specialists in physical education who have been concerned with the selection of major students in that field. The group was approved by the sponsoring committee as meeting the degree of quality that would make their opinions of value in the critical appraisal of the items included in the check list.

The selected educators were asked to indicate their opinion of the 46 procedures or practices included in the check list on the basis

of a five-point classification scale. Returns were received from a total of 34 (85 percent) of the 40 educators who were contacted. Eight of the general professional educators, six of those who had worked with student selection in general professional education, and all 20 of the physical educators responded.

Pre-Admission Selection Factors (See Table I).—Graduation from an accredited high school was rated most highly by the total group. Evidence of good moral character, and the requirement of specific high school subjects were rated about midway between the *useful* and *essential* categories. English and science were considered

TABLE I

SUMMARY OF OPINIONS OF EDUCATORS ON PRE-ADMISSION SELECTION PROCEDURES

Procedure	*Numerical Rating* *				
	Group 1	*Group 2*	*Group 3*	*Group 4*	*Total*
Graduation from Accredited High School	1.88	1.83	1.90	1.80	1.85
Moral Character	1.13	1.67	1.60	1.90	1.59
High School English	1.38	1.00	1.80	1.90	1.56
High School Science	1.25	1.17	1.70	1.70	1.50
Specific High School Subjects	1.13	1.17	1.70	1.50	1.41
Participation in High School Sports	1.00	1.00	1.20	1.40	1.15
Designated High School Rank	1.50	1.17	1.00	1.00	1.15
Letter of Recommendation	1.25	1.67	.70	1.10	1.12
Personality Ratings	1.13	1.67	.80	1.10	1.12
Participation in High School Student Affairs	1.00	1.00	1.10	1.20	1.09
Definite Number of High School Units	.63	.83	1.40	1.20	1.06
High School Mathematics	1.00	.67	1.10	1.10	1.00
16-Year Age Minimum	.75	.33	1.00	1.50	.97
Rating on Probable Physical Education Success	1.00	.67	.90	1.20	.97
Evidence of Citizenship	.25	1.50	.30	.60	.59

* 2 = essential; 1 = useful; 0 = of questionable value; —1 = unimportant; —2 = undesirable. Group 1 = general educators; Group 2 = general educators with selection experience; Group 3 = physical education administrators; Group 4 = physical educators with selection experience.

to be particularly valuable to the prospective students. Participation in high school sports and high school student affairs, a designated high school rank, letters of recommendation, personality ratings, and a definite number of high school units were all rated slightly higher than *useful* by the total group. Minimum age requirements, ratings on probable physical education success, and evidence of citizenship were given ratings between the *questionable* and the *useful* categories.

Classification Tests (See Table II).—Medical examinations, performance tests in physical education, mental or psychological tests, and speech or voice tests were all rated above the midpoint between the *useful* and *essential* categories. Information tests in physical

TABLE II

SUMMARY OF OPINIONS OF EDUCATORS ON CLASSIFICATION TESTS

Procedure	*Numerical Rating*				
	Group 1	*Group 2*	*Group 3*	*Group 4*	*Total*
Medical Examination	1.88	2.00	1.90	2.00	1.94
Performance Tests in Physical Education	1.63	1.67	1.50	1.80	1.65
Mental or Psychological Tests	1.63	1.67	1.60	1.60	1.62
Speech or Voice Tests	1.38	1.83	1.50	1.60	1.56
Information Test in Physical Education	1.50	1.67	1.20	1.50	1.44
Reading Tests	1.50	1.33	1.20	1.60	1.41
English Placement Tests	1.38	1.33	1.20	1.50	1.35
Personality Tests	1.25	1.00	1.20	1.50	1.26
Interest Tests	1.25	1.33	1.20	1.10	1.21
Subject-Matter Achievement Tests	1.25	1.33	.80	1.40	1.18
Contemporary Affairs Tests	1.38	1.17	.60	1.40	1.12
General Culture Tests	1.25	1.17	.70	1.40	1.12

education, together with reading and English tests approached the midpoint between the *useful* and *essential* ratings. Personality, interest, subject-matter achievement, contemporary affairs, and general culture tests were all given ratings in excess of the *useful* category.

TABLE III

SUMMARY OF OPINIONS OF EDUCATORS ON GENERAL SELECTION PROCEDURES DURING TRAINING

Procedure	*Numerical Rating*				
	Group 1	*Group 2*	*Group 3*	*Group 4*	*Total*
College Scholarship Standards	2.00	2.00	2.00	2.00	2.00
Continuous Guidance	2.00	1.83	2.00	1.80	1.91
Personal Interviews	1.50	2.00	1.90	2.00	1.85
Physical Competence Standards	1.50	1.67	1.70	1.80	1.68
Orientation Courses	1.25	1.83	1.90	1.60	1.65
Social Competence	1.25	1.67	1.50	1.90	1.59
Cumulative Records	2.00	1.67	1.00	1.70	1.56
Orientation Programs	1.38	1.50	1.70	1.50	1.53
Apprenticeship Teaching	1.25	1.67	1.60	1.10	1.44
Selection Committee	1.75	1.33	1.20	1.70	1.41
College Student Affairs Participation	1.38	1.17	1.20	1.50	1.32
Battery of Selection Factors	1.50	1.50	1.20	1.20	1.32
Sports Participation	1.25	1.33	1.10	1.20	1.21
Case-Study Techniques	1.50	1.17	.90	.80	1.06
Remedial Program	.38	1.50	.70	1.00	.88
Probationary Admission	—.50	.00	.70	.90	.32
Group Interviews	.62	.33	—.50	.40	.18
Point Scale Rating	.00	.00	.10	.30	.12

General Procedures During Training (See Table III).—College scholarship standards, evaluation of emotional stability, personal interviews, standards of physical and social competence, and orientation procedures including courses and general orientation programs were all given very high ratings. Each of these procedures was rated

above the midpoint between *useful* and *essential* by the total group. Participation in student affairs and sports in college were rated slightly above the *useful* category by the total group.

Administrative Procedures During Training (See Table III).—A continuous guidance program as a phase of selection was considered to be *essential* by 31 of the 34 replying. The maintenance of cumulative records, a selection committee, the use of a battery of factors and case-study techniques for selection purposes were all rated above the *useful* category by the total group. Remedial education programs, probationary admission of all candidates, group interviews, and ranking of candidates on a point scale were all rated below the *useful* category.

Comparison of Ratings.—Specific high school subjects, personal interviews, orientation procedures, and social and physical competence were rated more highly by the physical educators contacted than by the general professional educators who responded to the checklist. General professional educators who responded rated interest, contemporary affairs and general culture tests, sports participation, cumulative records, case-study techniques, and a battery of selection factors higher than did the physical educators included in the study.

Coefficients of correlation were computed from the ratings by the four groups of educators. These coefficients of correlation were based on the data in Tables I, II, and III. The results of these computations revealed consistency of rating of the 46 items included in the checklist. The coefficients of correlation and probable errors found between the ratings of the two groups of general professional educators on the three sets of selection items were .60 ± .12 (pre-admission); .70 ± .10 (classification tests); .73 ± .08 (general procedures). The coefficients found between the ratings of the two groups of physical educators were .84 ± .06 (pre-admission); .85 ± .06 (classification tests); .83 ± .05 (general procedures); and the coefficients found between the ratings of the combined groups of general professional educators with the combined groups of physical educators were .20 ± .18 (pre-admission); .87 ± .05 (classification tests); and .87 ± .04 (general procedures). Thus, the ratings of the groups of physical educators were slightly more consistent although those of the two groups of general professional educators were also quite similar. Only in the comparison of the combined ratings of the general professional educators with the physical educators on pre-admission selection procedures was there a deviation from this general similarity of rating by the authorities who cooperated in this study.

SUMMARY AND CONCLUSION

Catalog Study.—Study of catalogs of 227 schools offering a major in physical education revealed that 32 percent of the schools

listed a wide variety of procedures in use for selecting and retaining students. This group comprised the schools that seemed to be doing most to promote general selection procedures.

Checklist Study.—Fifteen percent of the administrators replying to the checklist considered their programs to be complete and adequate and 85 percent thought theirs were neither complete nor adequate.

Opinion Study.—Analysis of ratings by 34 specialists showed that the selection procedures ranked in the higher brackets of the rating scale would, if put into general use, seem to constitute a very comprehensive selection program. Seventeen of 46 procedures were rated above the midpoint, between useful and essential, and 22 more were rated useful. The high composite ratings indicate a definite trend in favor of selection that far exceeds the actual use of selection practices in the schools studied.

The general status of selection of men students for professional training in physical education is represented by the following list of typical procedures: (1) presentation of an official application blank and transcript of previous training and activities; (2) graduation from an accredited high school; (3) completion of a stated number of high school units; (4) a medical examination either by the family physician or the college health service; and (5) maintenance of minimum college scholarship standards. Additional selection and retention procedures included in the program of a number of schools studied were: (1) requirements of specific high school subjects; (2) a minimum high school rank or average; (3) recommendations or statements of character from high school principals; (4) personality ratings; (5) personal interviews; (6) intelligence or psychological tests; (7) English placement tests; (8) a battery of other tests established primarily for guidance purposes; and (9) limited upper-class barriers to continuation in training either at the junior level or upon application for practice teaching.

Conclusion.—The principal difficulty in selection of men for professional training in physical education seems to lie in the fact that the recommended measurements are not sufficiently adequate at present to predict the ultimate success of the candidates. Until such time as more useful predictive devices can be established, the clinical approach, in which a wide variety of items is used, should be helpful in determining the worth of applicants for professional training in physical education or for eliminating those who are unfit. In the meantime, controlled experiments should be carried out to determine what traits and abilities will predict success in the field, and long-range studies should be made to determine the elements involved in selecting and preparing capable teachers of physical education. Personal, social and cultural qualities, motivation, interest, and maturation are elements that are not readily measurable at present.

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A Factor Analysis of Motor Learning

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THERE is a need in physical education for an aptitude test, or tests, that will measure individual differences in the rate of learning gross bodily motor skills. Brace (4) has pointed out that such tests could be used to classify students into groups on the basis of their ability to learn motor skills and that the ability to learn might be increased by improving the traits involved in learning. However, additional information relative to the traits or factors involved seems necessary before such aptitude tests may be developed.

Many attempts have been made to measure, either directly or indirectly, the ability to learn gross bodily motor skills by the use of tests designed to measure motor ability (1, 3, 7, 10, 16, 19, 24), athletic ability (8, 9, 18, 22), motor educability (17), and motor capacity (7, 19). As far as the writer has been able to discover, the authors of the tests in these areas did not use as one of the original criteria of validity the learning that actually occurs during a controlled situation. Although there have been several experiments (4, 5, 6, 12) using such a criterion of learning, the writer has found no studies applying the factor analysis technique to the data. In this study, through the use of Thurstone's (25) complete centroid method of multiple factor analysis and his single-plane method of rotation, an attempt is made to secure information relating to the following purposes:

1. To identify some factors of motor learning as revealed in the improvement made on a group of so-called learning tests.

2. To study the relationship between motor learning, as measured in this study, and certain physical abilities, such as strength, speed, power, agility, endurance, motor ability, and athletic ability.

3. To compare, on the basis of factor loadings, three different methods of scoring learning tests.

4. To interpret the significance of the different types of motor learning that might be revealed by the learning tests used in this study.

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DESCRIPTION OF SUBJECTS AND TESTS

The reader is referred to Table II for a list of the 30 variables that were used in the factor analysis of this study. The data for these variables were obtained from the results of a research project conducted by Brace (5) during the fall of 1944. Burch (6), a research assistant working under the direction of Brace, obtained data on 100 seventh-grade girls in the University Junior High School at the University of Texas. The ages of these 100 girls ranged from ten to fourteen years with the ages of 97 of them being between eleven and thirteen years.

Height, weight, and age were obtained in the usual manner with height being measured to the nearest inch, weight to the nearest pound, and age to the nearest month.

The twenty items of the Brace Motor Ability Test were administered and scored in accordance with the directions set forth by Brace (3). The Brace Balance Items and the Brace Agility Items are those items in the Brace Motor Ability Test that were assumed by Brace to measure balance and agility. The Balance Items are items one, four, seven, nine, twelve, thirteen, fourteen, fifteen, eighteen, nineteen, and twenty, and the Agility Items are items two, six, seven, eight, ten, eleven, fifteen, and sixteen, as numbered in the original Brace test (3).

The items administered in the Iowa Revision of the Brace Test are the ten stunts that were selected by McCloy (17) to measure the motor educability of junior high school girls.

The Athletic Index used in this study is similar to that developed by McCloy (18) to measure general athletic ability. The Athletic Index was computed by adding the T-scale scores of the 50-yard dash, the standing broad jump, and the basketball throw for distance. Each of these events was also used as an independent measure, and for this purpose the three variables were expressed in raw scores.

The jump and reach as used in this study is essentially the same as the test proposed by Sargent (23). In administering the jump and reach the "chalk jump" method was used.

The Physical Performance Level Scores are the sum of the T-scale scores on eight events: the standing broad jump, the basketball throw for distance, the potato race, the pull-ups, the push-ups, the sit-ups, the 10-second squat thrust, and the 30-second squat thrust. These events were presented in 1943 as measures of physical fitness by the Research Committee of the National Section on Women's Athletics of the American Association for Health, Physical Education, and Recreation (21). Norms and full instructions for administering the tests were given by the Committee. The scores on the standing broad jump and the basketball throw for distance are the same as those used for the Athletic Index. As previously pointed out

these two events were used as independent measures expressed in raw scores. The remaining six events of the Physical Fitness Performance Level Scores were likewise used independently.

Learning Tests

Five separate so-called learning tests (5, 6) were used to measure the ability to learn gross bodily motor skills. In three of these tests, namely, the wall volley, the ball bounce, and the target toss tests, the amount of learning was expressed in terms of the improvement made in performance during 30 trials in rather simple activities. In the rhythm and tangle tests, the learning was represented by the number of trials required to execute the activities correctly.

The wall volley test consisted of volleying a volleyball against a wall as long as possible by using one or both hands. The subject stood behind a line drawn parallel to and three feet from a wall and volleyed the ball above a horizontal line drawn six feet above the floor. The volley was started with a two-hand toss against the wall. The number of volleys up to ten was recorded on each of 30 trials.

In the ball bounce test the subject was required to bounce a volleyball as long as possible on a bat of medium weight while standing in a circle six feet in diameter. The bat was held with one or both hands anywhere on its lower third. The score on each of the 30 trials was the number of times the ball was hit, including the tip on the last hit during each trial. In order to be considered a hit the ball had to bounce at least six to eight inches above the bat.

The target toss test consisted of using the chest shot to toss a basketball over a net at a horizontal target placed on the gymnasium floor. Three concentric circles, with diameters of one, three, and five feet, were used for the target. The net was stretched eight and one-half feet above a line drawn on the floor five feet from the outside circle of the target. The subject was required to stand behind a line drawn parallel to and five feet from the net and on the side of the net opposite the target. Three throws were allowed on each of 30 trials, and the score on each trial was computed on the basis of three points being given for any ball hitting within or on the line bounding the inner circle and two points and one point for the middle and outer circles respectively.

The tangle test consisted of a stunt with which most of the students were unfamiliar. The subject was required to lie on a mat in a prone position with the legs crossed at the ankles. The legs were then bent at the knees, lifting the crossed ankles into the air so that the toes could be grasped with the hands behind the back. With the toes of the right foot held firmly in the left hand and those of the left foot in the right hand, the individual rolled over on her back. Next she rocked the body forward until the feet were flat on the floor and

the body was in a position as upright as possible while still holding the toes with the hands. The legs were uncrossed by moving the one in front to its proper place, and the individual then stood erect after releasing the toes. The test was preceded by a demonstration.

The rhythm test involved timing, arm and leg coordination, and memory of movement, and consisted of a series of arm and leg movements. These movements were demonstrated twice, and the subject attempted to repeat the performance from memory. A tom-tom was used to accompany both the demonstration and the trials by the subject.

Reliability of Tests

With the exception of the learning tests, most of the variables used in this study are measures commonly employed in research in physical education, and they are generally considered to be reliable. For this reason retests on these events were not given by Burch, and it was therefore impossible to compute the coefficients of reliability from the data used for this study.

In order to determine the reliabilities of the three learning tests involving 30 trials each, Burch (6) used the "split-half" procedure and obtained coefficients of correlation between the odd and even trials. The reliability coefficients were .863 for the wall volley test, .805 for the ball bounce, and .775 for the target toss when computed on the basis of 30 trials. However, when computed on the basis of the first six trials, somewhat lower correlations of .614 for the wall volley, .504 for the ball bounce, and .605 for the target toss were obtained.

The reliabilities of the tangle and rhythm tests were not determined. These tests were very carefully administered by Burch, and it is felt that they are fairly reliable measures.

METHODS OF SCORING LEARNING TESTS

Three methods of scoring were used to measure the improvement made in the learning tests. These three methods are referred to as the Total Learning Score method, the Percent of Gain in Raw Score method, and the Percent of Gain in Scale Score * method. The first two methods were used also by Burch in her treatment of the data, and the third method was developed especially for this study. The Total Learning Score method was used to measure the improvement in all five tests, and the two percent of gain methods were used only for the wall volley, ball bounce, and target toss tests.

Total Learning Score Method

The Total Learning Score is the sum of the scores made on each of the 30 trials for the wall volley, ball bounce, and target toss tests,

* The scale score referred to in this method is a T-scale score.

and it is the number of trials required to perform the activity correctly in the tangle and rhythm tests. The theory of the Total Learning Score in regard to tests involving repeated trials is that those persons who possess high learning ability will make larger scores than those with low learning ability. This does not deny that such factors as physique, organic condition, and natural endowment do not also contribute to the total score. In this method the performance on all of the trials is reflected in the score, thus credit is given to those having high initial scores and those reaching their maximum performance before the end of the practice period. However, too much credit seems to be given to initial status since a person with a fairly high initial score could have a high learning score just by maintaining the same level of performance throughout without showing any indications of improvement. On the other hand, a person could have a low initial score but reach a very high level of performance near the end of the test and still have a lower total score than the person with the fairly high initial score. For example, the scores might run as follows:

Case 1: 6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6 180

Case 2: 3-3-3-3-3-4-4-4-4-4-5-5-5-5-5-6-6-6-6-6-7-7-7-7-7-8-8-8-8-8-8 165

Undoubtedly more improvement is indicated in Case 2, but the total learning score is lower than in Case 1. However, it must not be assumed that the individual in Case 1 does not possess ability to learn since he may have reached his maximum performance in some earlier learning period, and such a high initial score may be due to other factors than learning.

In the two percent of gain methods an attempt is made to measure the individual's gain over his initial status in terms of the possible gain remaining after his initial score. The sum of the first five trials is used as the initial score in each of these two methods. This furnishes a fairly reliable measure of initial status and yet the period is not long enough to allow any marked improvement (5). These two methods differ in the computation of the final score and possible gain and in the use of raw scores for one and T-scale scores for the other.

Percent of Gain in Raw Score Method

The Percent of Gain in Raw Scores (5) is obtained by dividing the actual gain by the possible gain as indicated in the following formula:

$$\text{Percent of Gain in Raw Scores} = \frac{\text{Total learning score—Initial score}}{\text{Maximum possible total learning score—Initial score}}$$

For example, the maximum possible score that could be made during 30 trials on a given test is 300. The sum of the first five trials, or the initial score for an individual, is 15, and the total score on all trials is 117. The actual gain made after the first five trials then would be 117 — 15 = 102, and the maximum possible gain would be 300 — 15 = 285. The percent of gain would be 102 ÷ 285 = 35.8 percent (5).

Percent of Gain in Scale Score Method

The Percent of Gain in Scale Score method is believed to be the most adequate of the three methods used in this study to measure the improvement made during successive trials on a practice test. As previously mentioned, the initial score is the sum of the first five trials, but in this method the raw scores on the first five trials are converted to T-scale scores so that the individual's status is revealed in terms of that of the entire group or in terms of the difficulty of the test. To obtain the final score the best five scores of the 25 trials remaining after the initial score are selected and summed, and this raw score is converted to a score on the same T-scale constructed by use of the initial scores. The highest possible score is obtained by selecting the highest single score made by any individual on any one of the 30 trials and multiplying this score by five so that it may be compared with the initial and final scores. This value is converted to a scale score on the same T-scale used for the initial and final scores. Although it might be possible theoretically to make a score higher than this, this method gives the highest possible score in terms of the ability of the group.

The Percent of Gain in Scale Scores is computed by dividing the gain in scale scores by the possible gain in scale scores as follows:

$$\text{Percent of Gain in Scale Scores} = \frac{\text{Final score in scale scores—Initial score in scale scores}}{\text{Maximum possible score in scale scores—Initial score in scale scores}}$$

For example, for an individual in the target toss test the initial score, which was the sum of the first five trials, was 22 in raw score; and the final score, which was the sum of best five scores after the first five trials, was 36. The highest score made by any individual on any one trial was 9; thus, 9 × 5 or 45 was used as the highest possible raw score that could have been made on five trials. On the basis of a T-scale table computed from the initial scores, these raw scores were converted to T-scale scores. This individual then had an initial T-scale score of 54 and a final score of 78, and the highest possible T-scale score for five trials was 93. The actual gain after the initial score was 78 — 54 = 24, and the possible gain was 93— 54 = 39. The percent of gain was 24 ÷ 39 = 61.5 percent.

CORRELATION AND FACTOR MATRICES

Since factor analysis begins with a correlation matrix, it was necessary to compute the zero-order coefficients of correlations among the 30 variables used in this study. The 435 correlations among the 30 variables are presented in Table I. There are 376 positive, 54 negative, and 5 zero correlations represented in this matrix. Most of the negative correlations are those between height, weight, and age and the other variables. The positive correlations range from .01 to .99, and the negative, from —.01 to —.53. Although most of the 435 correlations are within the range of .20 to .70, there are a few correlations that are rather high and several that are almost negligible. The highest correlations would indicate that there are several tests measuring the same factor, and the lowest would suggest that different factors are involved among the variables.

Eight separate factors were isolated, and the loadings of the 30 variables on these factors are presented in Table II. The loadings range from —.47 to +.84 with relatively few negative values. It will be noted that each factor has a few tests with fairly high loadings and several tests with near zero loadings. Such an arrangement should aid in the interpretation since the factor is named in terms of the tests having high loadings on the factor. However, it must be remembered that the naming of factors is most difficult and is subject to personal interpretations. No claim is made that the nomenclature used for the factors in this study is unique.

The factor loadings are expressed in terms of fractional decimals, ranging from —1.00 to +1.00 and are interpreted as the zero order validity coefficients between the tests and the factor. Before proceeding with an interpretation of the factors, a decision must be made concerning the relative values of the loadings. Based on the limits used by other writers (14, 15, 20, 26) for interpreting the significance of factor loadings and of correlations, and on the general nature of the loadings in this study, the following limits were selected to aid in the interpretation of the variables:

Under .20, near zero; considered to have no relationship.
.20-40, low but insignificant loadings; some relationship.
.40-.70, significant; considerable relationship.
Over .70, very significant; very high relationship.

COMPARISON, ON THE BASIS OF FACTOR LOADINGS, OF THE THREE METHODS OF SCORING THE LEARNING TESTS

The interpretations of the different factor loadings in the naming of the factors will include reference to the loadings of the three learning tests that were scored by the three different methods. In order that the reader may understand the relationship among the three

TABLE I

Correlation Matrix

	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1. Height		.64	.26	−.10	−.10	−.01	−.16	.15	.14	−.23	−.01	.22	−.20	−.48	−.22	−.11	−.24	−.04	−.01	.21	.24	−.11	−.07	−.09	.20	.24	.10	.14	.25	.00
2. Weight	.64		.11	−.29	−.28	−.14	−.37	−.12	−.05	−.03	−.28	−.26	−.05	−.53	−.24	−.07	−.26	−.20	−.25	.16	.17	−.00	−.18	−.10	.17	.16	.00	.05	.12	.12
3. Age	.26	.11		.05	.03	.07	.10	.25	.17	.18	.05	.15	−.16	−.10	.01	−.08	−.15	−.01	.07	.18	.24	−.29	−.10	−.04	.19	.25	−.29	−.07	.25	.14
4. Brace Motor Ability Test	−.10	−.29	.05		.91	.84	.71	.49	.54	.46	.51	.28	.33	.41	.40	.40	.16	.41	.63	.19	.31	.38	.36	.20	.16	.32	.37	.17	.24	.04
5. Brace Balance Items	−.10	−.28	.03	.91		.67	.61	.43	.51	.40	.47	.30	.31	.34	.31	.33	.18	.39	.57	.12	.25	.35	.32	.17	.09	.26	.34	.12	.19	.04
6. Brace Agility Items	−.01	−.14	.07	.84	.67		.59	.43	.41	.42	.31	.25	.28	.31	.32	.31	.10	.30	.48	.25	.32	.31	.26	.24	.23	.33	.30	.18	.24	.05
7. Iowa Revision of the Brace Test	−.16	−.37	.10	.71	.61	.59		.43	.47	.45	.51	.16	.34	.43	.41	.42	.08	.34	.57	.13	.29	.30	.20	.14	.09	.30	.30	.09	.27	.16
8. 50-Yard Dash	.15	−.12	.25	.49	.43	.43	.43		.81	.54	.61	.43	.43	.34	.36	.30	−.01	.19	.58	.47	.44	.50	.06	.01	.44	.43	.49	.36	.41	.15
9. Athletic Index	.14	−.05	.17	.54	.51	.41	.47	.81		.62	.81	.75	.42	.42	.41	.45	.08	.19	.78	.59	.62	.64	.18	.06	.54	.61	.63	.47	.59	.18
10. Jump and Reach	.23	−.03	.18	.46	.40	.42	.45	.54	.62		.49	.45	.36	.33	.27	.40	−.04	.23	.56	.43	.57	.49	.25	.08	.41	.57	.50	.33	.54	.07
11. Standing Broad Jump	−.01	−.28	.05	.51	.47	.31	.51	.61	.81	.49		.32	.40	.47	.41	.50	.20	.25	.76	.40	.48	.50	.30	.05	.37	.47	.49	.39	.43	.13
12. Basketball Throw for Distance	.22	.26	.15	.28	.30	.25	.16	.43	.75	.45	.32		.20	.17	.20	.26	.01	.02	.48	.51	.56	.50	.05	.03	.47	.55	.51	.34	.55	.14
13. Potato Race	.20	−.05	.16	.33	.31	.28	.34	.43	.42	.36	.40	.20		.15	.24	.25	.04	.22	.61	.20	.36	.31	.16	.08	.21	.37	.25	.16	.40	−.06
14. Pull-ups	−.48	−.53	−.10	.41	.34	.31	.43	.34	.42	.33	.47	.17	.15		.37	.39	.28	.22	.57	.18	.21	.22	.16	.11	.17	.21	.20	.20	.21	−.04
15. Push-ups	−.22	−.24	.01	.40	.31	.32	.41	.36	.41	.27	.41	.20	.24	.37		.30	.11	.26	.56	.17	.23	.14	.03	.11	.19	.24	.17	.07	.24	.05
16. Sit-ups	.11	−.07	.08	.40	.33	.31	.42	.30	.45	.40	.50	.26	.25	.39	.30		.13	.30	.66	.30	.41	.39	.19	.13	.28	.41	.37	.22	.39	.12
17. 10-second Squat Thrust	−.24	−.26	−.15	.16	.18	.10	.08	−.01	.08	−.04	.20	.01	.04	.28	.11	.13		.37	.42	−.04	.01	−.12	.16	.00	−.03	.01	−.14	.05	−.03	−.17
18. 30-second Squat Thrust	−.04	−.20	−.01	.41	.39	.30	.34	.19	.19	.23	.25	.02	.22	.22	.26	.30	.37		.56	−.02	.12	.02	.17	.05	−.01	.11	.01	.06	.04	−.24
19. Physical Performance Levels	−.01	−.25	.07	.63	.57	.48	.57	.58	.78	.56	.76	.48	.61	.57	.56	.66	.42	.56		.38	.52	.45	.26	.13	.36	.29	.43	.33	.50	−.02
20. Total Score for Wall Volley	.21	.16	.18	.19	.12	.25	.13	.47	.59	.43	.40	.51	.20	.18	.17	.30	−.04	−.02	.38		.61	.58	−.03	.06	.99	.59	.56	.75	.56	.00
21. Total Score for Ball Bounce	.24	.17	.24	.31	.25	.32	.29	.44	.62	.57	.48	.56	.36	.21	.23	.41	.01	.12	.52	.61		.51	.09	.14	.61	.99	.48	.48	.91	.05
22. Total Score for Target Toss	.11	.00	.29	.38	.35	.31	.30	.50	.64	.49	.50	.50	.31	.22	.14	.39	−.12	.02	.45	.58	.51		.17	.07	.55	.52	.98	.41	.52	.39
23. Total Score for Tangle Test	−.07	−.18	−.10	.36	.32	.26	.20	.06	.18	.25	.30	.05	.16	.16	.03	.19	.16	.17	.26	−.03	.09	.17		.32	−.05	.10	.16	.12	.02	.08
24. Total Score for Rhythm Test	−.09	−.10	−.04	.20	.17	.24	.14	.01	.06	.08	.05	.03	.08	.11	.11	.13	.00	.05	.13	.06	.14	.07	.32		.05	.15	.04	.16	.08	−.08
25. Percent Gain in Raw Score for Wall Volley	.20	.17	.19	.16	.09	.23	.09	.44	.54	.41	.37	.47	.21	.17	.19	.28	−.03	−.01	.36	.99	.61	.55	−.05	.05		.60	.53	.74	.56	−.01
26. Percent Gain in Raw Score for Ball Bounce	.24	.16	.25	.32	.26	.33	.30	.43	.61	.57	.47	.55	.37	.21	.24	.41	.01	.11	.29	.59	.99	.52	.10	.15	.60		.49	.46	.93	.07
27. Percent Gain in Raw Score for Target Toss	.10	.00	.29	.37	.34	.30	.30	.49	.63	.50	.49	.51	.25	.20	.17	.37	−.14	.01	.43	.56	.48	.98	.16	.04	.53	.49		.39	.49	.46
28. Percent Gain in Scale Score for Wall Volley	.14	.05	−.07	.17	.12	.18	.09	.36	.47	.33	.39	.34	.16	.20	.07	.22	.05	.06	.33	.75	.48	.41	.12	.16	.74	.46	.39		.39	−.05
29. Percent Gain in Scale Score for Ball Bounce	.25	.12	.25	.24	.19	.24	.27	.41	.59	.54	.43	.55	.40	.21	.24	.39	−.03	.04	.50	.56	.91	.52	.02	.08	.56	.93	.49	.39		.05
30. Percent Gain in Scale Score for Target Toss	.00	.12	.14	.04	.04	.05	.16	.15	.18	.07	.13	.14	−.06	−.04	.05	.12	−.17	−.24	−.02	.00	.05	.39	.08	−.08	−.01	.07	.46	−.05	.05	

TABLE II

ROTATED FACTOR MATRIX

	I	II	III	IV	V	VI	VII	VIII	h^2
1. Height	.77	.30	—.01	—.21	—.03	—.15	.00	—.07	.7554
2. Weight	.56	.13	—.09	—.18	.05	—.29	.12	.10	.4820
3. Age	.15	.16	.17	—.16	—.09	—.21	.23	.14	.2273
4. Brace Motor Ability Test	—.04	.23	.76	.35	.12	.47	—.04	.07	.9964
5. Brace Balance Items	—.01	.26	.63	.33	.09	.46	—.08	.11	.8117
6. Brace Agility Items	.00	.10	.72	.20	.15	.34	.05	—.01	.7091
7. Iowa Revision of the Brace Test	—.09	.18	.49	.24	—.10	.31	.11	.00	.4564
8. 50-yard Dash	.02	.62	.16	.11	.19	.03	.17	.06	.4920
9. Athletic Index	.05	.71	.01	.31	.30	.15	.31	.24	.8690
10. Jump and Reach	.20	.27	.23	.09	.14	.22	.30	.07	.3368
11. Standing Broad Jump	—.02	.41	—.08	.33	.16	.40	.23	.11	.5344
12. Basketball Throw for Distance	.13	.44	.03	.18	.35	—.01	.40	.32	.6288
13. Potato Race	.27	.23	.13	.17	—.02	.20	.15	—.15	.2570
14. Pull-ups	—.47	.05	.05	.41	.18	.28	.22	.01	.5533
15. Push-ups	—.21	.21	.16	.37	.05	.08	.23	—.07	.3174
16. Sit-ups	.12	.13	.11	.39	.11	.39	.31	.11	.4679
17. 10-second Squat Thrust	—.11	.00	—.05	.57	.17	.31	.01	—.13	.4815
18. 30-second Squat Thrust	.13	.09	.21	.52	.04	.36	—.02	—.24	.5287
19. Physical Performance Levels	.09	.47	.14	.80	.25	.46	.26	—.06	1.0000
20. Total Score for Wall Volley	—.03	.24	.03	.04	.81	.01	.49	.16	.9829
21. Total Score for Ball Bounce	.26	.03	.06	.09	.20	.07	.81	.07	.7861
22. Total Score for Target Toss	.00	.29	.18	—.03	.35	.26	.38	.69	.9280
23. Total Score for Tangle Test	.14	—.13	.10	.06	—.04	[illegible]	—.13	.03	.4416
24. Total Score for Rhythm Test	.04	—.26	.16	—.05	.04	.37	.00	—.10	.2458
25. Percent Gain in Raw Score for Wall Volley	—.06	.20	.02	.04	.79	—.02	.54	.13	.9786
26. Percent Gain in Raw Score for Ball Bounce	.21	—.04	.12	—.01	.14	.05	.84	.11	.8000
27. Percent Gain in Raw Score for Target Toss	—.03	.33	.16	—.01	.32	.23	.38	.76	1.0000
28. Percent Gain in Scale Score for Wall Volley	.03	.10	—.10	.03	.66	.26	.26	.04	.5942
29. Percent Gain in Scale Score for Ball Bounce	.20	.06	.03	.05	.14	—.02	.80	.08	.7134
30. Percent Gain in Scale Score for Target Toss	—.07	.18	.00	—.12	—.11	—.01	.09	.57	.3969

methods of scoring the learning tests, it is felt that a comparison, on the basis of the factor loadings, of the three methods should be presented at this point.

A study of Table II will reveal that similar loadings have been obtained on each of the eight factors for each test scored by the three methods. The differences between the loadings of the tests scored by the Total Learning Score method and the Percent of Gain in Raw Score Method range from .00 to .10; therefore, there seems to be practically no difference between these two methods of scoring as regards factor loadings. The differences between the loadings of the tests scored by the Percent of Gain in Scale Score method and those for the other two methods are slightly higher with the most marked difference being in the target toss test. The ranges of the differences for each of the tests are as follows: .01 to .28 for the wall volley, .01 to .10 for the ball bounce, and .04 to .46 for the target toss. While a few of these are near significant differences, most of them are under .20 and, according to the limits established previously, may be considered to be near zero. It seems, therefore, that on the basis of the factor loadings obtained in this study there are in general no significant differences among the methods of scoring these three learning tests.

NAMING OF THE FACTORS

Factor I seems to be one of body size since the highest loading is on height, a direct measurement of body size, and the second highest loading is on weight, at least an indirect measurement of body size. The significant negative loading on the pull-ups suggests that there may be a surplus size or perhaps a dead weight operating and that the muscles of the arm and shoulder-girdle have not developed in proportion to the growth of the body as a whole. However, Factor I accounts for about 59 percent of the variance in height and for only 22 percent in the pull-ups; thus, it seems that pure body size is involved more in this factor than is surplus size or dead weight. This factor is, therefore, called Body Size. It will be noted that the loadings of this factor on the key tests of the other factors and four of the learning tests scored by one of the three methods are near zero, indicating that body size is not involved in them. The loadings on the ball bounce, although above .20, are not high enough to be considered.

Factor II has its highest loading on the Athletic Index and significant loadings are found on the events comprising the Athletic Index. It appears that this factor may be called Athletic Ability since the Athletic Index was presented as a measure of athletic ability. This factor accounts for only about 50 percent of the variance of the Athletic Index, and it is noted that the Athletic Index has low but

insignificant loadings on Factors IV, V, VII, and VIII. However, it is possible that the loadings of the Athletic Index on the other factors may be due to the influence of the separate events in the battery rather than to any factor that the battery as a whole may measure. There is further evidence that athletic ability is the dominant factor in the Athletic Index in the significant loadings on Factor II of the Physical Performance Levels, which are composed of a variety of events calling for athletic ability. It is noted that this factor does not have significant loadings on any of the learning tests or the key tests of the other factors. There are, however, low but insignificant positive loadings on the target toss and wall volley and a low negative loading on the rhythm test.

Factor III is clearly something that is measured by the motor ability tests since the highest loading is on the Brace Motor Ability Test with only slightly smaller loadings on the Brace Agility Items and the Brace Balance Items. This factor accounts for a large portion of the common factor variance of the tests. It is interesting to note that the tangle test, which is considered to be a stunt-type test, has a near zero loading on this factor and that the tests with heavy loadings are those involving stunt-type activities. On the other hand, as will be revealed subsequently, the Brace Motor Ability Test has a significant loading on Factor VI, which involves the tangle test primarily. It is clearly evident that this factor is not involved in the learning tests nor the key tests of the other factors since the loadings of these tests are below .20. It was decided to call this factor Motor Ability in terms of the Brace tests.

Factor IV appears definitely to be whatever is measured by the Physical Performance Levels inasmuch as it accounts for approximately 64 percent of the variance of this battery. Also the only other significant loadings are on the events comprising the battery. Since the Physical Performance Levels were proposed as a measure of physical fitness in terms of strength, speed, agility, endurance, and power, it was decided to name Factor IV Physical Fitness Performance. It is noted that all the learning tests have loadings of less than .20 on this factor. Low but insignificant loadings are found on the key tests for the first three factors.

Each of the next four factors has its highest loading on a separate learning test and accounts for a large percentage of the common factor variance of each test, indicating that there are at least four different types of learning involved among the tests. At the beginning of the factoring it was rather expected that distinct factors, such as speed, strength, agility, and endurance, might be isolated and that the interpretations of the abilities involved in the learning tests might be based on the loadings on these factors. It is still possible to make such an interpretation on the basis of the somewhat

general abilities or traits of the first four factors of this study; however, the isolation of distinct factors for different learning tests should facilitate the interpretations. It should now be possible to identify a factor in terms of the learning test involved and also to determine the influence on the factor of such abilities as speed, strength, agility, power, and endurance on the basis of the loadings of the tests reputed to measure such abilities.

Factor V has its highest loadings on the wall volley scored by each of the three methods and has insignificant loadings on all other tests. It has, therefore, been named in terms of the wall volley and is called Dynamic Object Control without Implement in Sport-Type Motor Learning. The terminology for this as well as subsequent factors is functional rather than organic, indicating that it is a factor of performance rather than one of body structure. In the wall volley the activity seems to involve primarily receiving and redirecting an object with the hands as the object rebounds from a wall. Controlling the object requires a sort of thinking—a judgment of speed and direction—and a control of the power applied to the object without the aid of an implement, such as the bat that is used in the ball bounce. It is a dynamic control of an object already in motion in contrast to setting it in motion as is done in the target toss.

Since object control is an important factor in most sports, such as basketball, volleyball, baseball, golf, tennis, and handball, it seems that the wall volley measures a sport-type activity. This contention is substantiated somewhat by the low but insignificant loadings on the Athletic Index, basketball throw for distance, and the Physical Performance Levels and also by the absence of this factor in stunt-type activities since the Brace, tangle, and rhythm tests have near-zero loadings on this factor.

Factor VI has been named Bodily Coordination in Stunt-Type Motor Learning in terms of the tangle test, which has the highest loading of any test on this factor and which has near zero loadings on all other factors. However, this nomenclature must be accepted with reservation since the factor accounts for only 37 percent of the variance in the tangle test. This factor does not seem to be involved in the so-called sport-type learning of the wall volley, ball bounce, and target toss, for the loadings are rather low for these tests. There are significant loadings on the stunt-type activities of the Brace Motor Ability Test and the Brace Balance Items, but it seems that this might be due to the influence of such items as power, agility, and strength in the Brace tests. The significant loading on the Physical Performance Levels is difficult to explain unless it is the presence of such physical fitness items as agility, power, strength, and endurance, which the Physical Performance Levels were set up to measure. The significant loading on the standing broad jump may be due to the

power required in the legs in assuming an upright position in the tangle test.

Factor VII has very high loadings on the ball bounce, which is a test involving the control of a rebounding object through the use of an implement. It is called Dynamic Object Control with Implement in Sport-Type Motor Learning. Just as in the wall volley, the control of the object requires a sense of timing and adjustment of power applied to the object, but in this case the power is applied through an implement. Also, as is the case in the wall volley, it is a control of an object already in motion. The distinctive difference between the two tests causing separate factors in this analysis seems to be the use of an implement in one to control the object. The contention that object control is important in sport-type activity is borne out by the significant loading on the basketball throw for distance, by the low but insignificant loadings on the Athletic Index and the Physical Performance Levels, and by the zero loadings on the Brace and tangle tests.

Factor VIII has significant loadings only on the target toss and should be named in terms of what this test seems to measure. The target toss has near significant loadings on Factors V and VII, and it seems that this may be due to the object control element in the target toss. On the other hand the wall volley and the ball bounce, the key tests in Factors V and VII, have near-zero loadings on Factor VIII. Therefore, it seems that Factor VIII might involve the target toss minus object control. In the target toss the activity, aside from the object control, appears to involve primarily the ability to control neuromusclar coordinations in the correction of errors in throwing at a target. Certain adjustments in order to control the force and direction of the object are also necessary in the wall volley and the ball bounce, but in these two tests it is a dynamic adjustment with some freedom of body movement. In the target toss the individual makes the adjustment through static object control while in a static body position. It appears that the emphasis in the wall volley and the ball bounce is on object control and that in the target toss it is on the aiming. It seems logical to designate Factor VIII as Aiming Control in Static Body Position in Sport-Type Motor Learning.

It is interesting to note that all other tests have near-zero loadings on this factor with the exception of the low but insignificant positive loadings of the basketball throw for distance and the Athletic Index and the low but insignificant negative loading of the 30-second squat thrust. The loadings of the basketball throw for distance and the Athletic Index indicate slightly that this is a sport-type factor, but it seems to be less important than Factors V and VII in sport-type motor learning. This reasoning seems logical when one considers that in sports in general there are relatively few instances in which

the individual aims from a static position in comparison to those in which he is dynamically controlling an object. Factor VIII might be important for the pitcher and individuals throwing at a specific spot in baseball or for the basketball player shooting from a set position, but in other instances in baseball and basketball and in volleyball, handball, soccer, badminton, and many other sports, this factor would probably not be so important.

RELATIONSHIP BETWEEN MOTOR LEARNING AND CERTAIN MEASURES OF PHYSICAL ABILITIES

The discussion of this topic will involve consideration of the relationship between the five learning tests and the four factors of physical ability, including the factor of body size, as identified in this study. It will involve also a discussion of the relationship between the four factors of motor learning, as identified in this study, and tests commonly accepted as measures of certain physical abilities. The certain physical abilities referred to at this point are speed, motor ability, athletic ability, agility, power, strength, endurance, and throwing for distance.

Some insight into these relationships has been given in the preceding discussion dealing with the naming of the factors. It is the purpose of this section to aid in the understanding of these relationships by focusing attention on the factor loadings relating to this problem.

TABLE III

LOADINGS OF LEARNING TESTS ON THE FIRST FOUR FACTORS

	Factors	*Wall Volley*	*Ball Bounce*	*Target Toss*	*Tangle Test*	*Rhythm Test*
I.	Body Size	—.06 to .03	.20 to .26	—.07 to .00	.14	.04
II.	Athletic Ability	.10 to .24	—.04 to .06	.18 to .33	—.13	—.26
III.	Motor Ability	—.10 to .03	.03 to .12	.00 to .18	.10	.16
IV.	Physical Fitness	.03 to .04	—.01 to .09	—.12 to —.01	.06	—.05

In Table III are presented the loadings of the five learning tests on the first four factors of this study. The entries for the wall volley, ball bounce, and target toss represent the range of loadings for the three methods of scoring each test. It is interesting to note that with four exceptions the loadings are below .20, indicating that these factors in general are responsible for less than four percent of the variance of the tests.

It seems that Body Size does not enter into any of the learning tests to any extent, as is shown by the loadings of the tests on Factor I. Two of the three sport-type learning tests quite logically have positive loadings on Factor II, Athletic Ability, while the stunt-type tests have negative loadings. However, the presence or the

absence of Factor II accounts for very little of the variance in the tests. There seems to be no pattern of loadings indicating any difference between the sport-type tests and stunt-type tests as far as Factors III and IV are concerned. These two factors have near-zero loadings on all of the learning tests.

The loadings of the tests commonly accepted as measures of certain physical abilities on the four factors of motor learning are presented in Table IV. The tests of physical abilities have been grouped according to the specific ability that each is usually considered to measure. When more than one test is used for a specific ability, the entries indicate the range of the factor loadings.

TABLE IV

LOADINGS OF TESTS OF CERTAIN PHYSICAL ABILITIES ON THE FACTORS OF MOTOR LEARNING

Physical Abilities and Their Tests	*Factor V Dynamic Object Control without Implement (Wall Volley)*	*Factor VI Bodily Co-ordination in Stunt-Type Learning (Tangle)*	*Factor VII Dynamic Object Control with Implement (Ball Bounce)*	*Factor VIII Aiming Control in Sport-Type Learning (Target Toss)*
Speed: 50-yard Dash, Potato Race	—.02 to .19	.03 to .20	.15 to .17	—.15 to .06
Motor Ability: Brace Test, Brace Balance Items, Brace Agility Items, Iowa-Brace	—.10 to .15	.31 to .47	—.08 to .11	—.01 to .11
Agility: 10-second Squat Thrust, Brace Agility Items	.15 to .17	.31 to .34	.01 to .05	—.13 to —.01
Power: Standing Broad Jump, Jump and Reach	.14 to .16	.22 to .40	.23 to .30	.07 to .11
Strength: Pull-ups, Push-ups, Sit-ups	.05 to .18	.08 to .39	.22 to .31	—.07 to .11
Endurance: 30-second Squat Thrust	.04	.36	—.02	—.24
Throwing for Distance: Basketball Throw for Distance	.35	—.01	.40	.32
Athletic Ability: Athletic Index	.30	.15	.31	.24

The highest loading for any of the tests of specific abilities on any factor is .47, and in over 50 percent of the different groups of loadings, there is no loading above .20. This seems to indicate that in general these specific abilities are not involved in the factors of motor learning, as identified from the data used in this study.

Speed seems to be involved the least of all the specific factors

since the loadings for the tests of speed are near zero on all four factors. This is easy to understand in view of the fact that in none of the learning tests did the scoring involve a time element; therefore, speed was not an essential item.

Motor ability seems to be involved only in Factor VI, and mention has already been made of the possibility that such items as power, agility, and strength might cause the motor ability tests to be loaded on this factor. The highest loading of any test of motor ability on Factor VI is only .47, indicating that this factor accounts for less than 23 percent of the variance in each of the motor ability tests. The loadings of these tests on the other factors are near zero. These facts point out that neither the Brace Motor Ability Test nor the Iowa Revision of the Brace Test can be called a test of motor educability, if the learning tests of this study are measures of motor educability.

Tests of agility have near-zero loadings on all factors with the exception of Factor VI. The ability to change rather quickly the direction of the motion of different parts of the body in relation to the body as a whole could logically be involved in bodily coordination in stunt-type activities.

Tests of power have near-zero loadings on Factors V and VIII with only slightly higher loadings on Factor VII. This is to be expected since none of the factors of sport-type motor learning involves the ability to spring into the air. It has already been pointed out that the near-significant loading on Factor VI may be due to the use of the legs in coming to an upright position in this activity. Strength and endurance also seem to be involved in the bodily coordination of stunt-type activities, and they both have near zero, or very low, loadings on the other factors.

The basketball throw for distance has near-significant loadings on Factors V, VII, and VIII and practically a zero loading on Factor VI. It seems that the throwing for distance measured by this test is clearly an ability involved in sport-type activity rather than stunt-type activity. The fact that the Athletic Index has its highest loadings on Factors V, VII, and VIII indicates that the Index or specific tests composing the Index are also involved in the factors of sport-type motor learning.

INTERPRETING THE SIGNIFICANCE OF THE DIFFERENT TYPES OF MOTOR LEARNING

Brace (5), in commenting on the data used in this study, advocated that there may be at least two types of motor learning, namely sport-type and stunt-type. This investigator referred to the wall volley, ball bounce, and target toss as sport-type learning tests and to the tangle as a stunt-type learning test. His classification seems to be borne out somewhat in the analysis in this study by comparable loadings of the tests of athletic skill in the factors of sport-type motor

learning and by the loadings of stunt-type activities on the stunt-type factor.

Although there are indications that three of the factors of this study might involve sport-type motor learning and one factor, stunt-type motor learning, none of the loadings is sufficiently high to substantiate a contention that any one of the factors is a measure of any of the commonly accepted elements of physical ability, such as speed, motor ability, athletic ability, agility, power, endurance, and throwing for distance. Nor does it seem likely that a combination of the learning factors would yield such a measure. How, then, can these factors of motor learning be designated sport-type or stunt-type motor learning, as has been suggested on the basis of the analysis in this study?

It seems that if these be factors of motor learning each factor is involved in only a specific part of an activity. For example, a person might possess a considerable amount of the ability involved in Factor VIII and could control his aim in those sports requiring such ability. Such an ability would be of value for the baseball pitcher, but perhaps there are other factors, such as strength, speed, and endurance, that go together with aiming control to make a successful pitcher. This leads to the suggestion that there are possibly many separate factors of motor learning not yet identified causing individual differences in performance in sports, or in different activities in a sport. Or there are possibly many different combinations of separate factors causing differences. This study suggests that such factors may be functional rather than organic. It is evident that much more research relative to the nature of factors of motor learning and physical performance is needed before definite decisions can be made as to the factors involved in learning gross bodily skills. It is the opinion of the writer that the method of factor analysis should prove to be a most valuable tool in future research in this area.

SUMMARY OF FINDINGS AND CONCLUSIONS

The centroid method of multiple factor analysis was used to study the relationship among a group of learning tests and tests commonly accepted as measures of such physical abilities as motor ability, athletic ability, strength, speed, power, agility, and endurance. A total of 30 variables was used in the analysis, and the data for these variables were obtained from tests administered to 100 junior high school girls.

Eight rather distinct factors were isolated and these factors were named as follows:

1. Factor I, Body Size.
2. Factor II, Athletic Ability.
3. Factor III, Motor Ability.
4. Factor IV, Physical Fitness Performance.

5. Factor V, Dynamic Object Control without Implement in Sport-Type Motor Learning.

6. Factor VI, Bodily Coordination in Stunt-Type Motor Learning.

7. Factor VII, Dynamic Object Control with Implement in Sport-Type Motor Learning.

8. Factor VIII, Aiming Control in Static Body Position in Sport-Type Motor Learning.

On the basis of the loadings of pertinent tests on these factors, the writer felt warranted in drawing the following conclusions:

1. There seem to be in general no significant differences among the factor loadings produced by the three methods of scoring the learning tests. The greatest difference exists between the Percent of Gain in Scale Score method and the other two methods, with the most pronounced difference in the target-toss test.

2. The first four factors are rather general in nature and appear to involve physical abilities or measurements of body size with Factor I being the dominant factor in height and weight, Factor II, in the Athletic Index, Factor III, in the motor ability tests, and Factor IV, in the Physical Performance Levels.

3. The last four factors appear to be factors of motor learning and, as far as the writer has been able to discover, are unique for this study. Three of these factors seem to involve sport-type motor learning and one, stunt-type motor learning.

4. A different factor seems to be dominant in each of four learning tests as follows: Factor V in the wall volley, Factor VI in the tangle, Factor VII in the ball bounce, and Factor VIII in the target toss.

5. None of the first four factors appears to be involved in any of the five learning tests since in general each accounts for less than four percent of the variance of the tests.

6. In general the tests commonly accepted as measures of motor ability, athletic ability, speed, agility, power, strength, and throwing for distance, are not influenced by the factors of motor learning. In most instances each factor accounts for less than four percent of the variance in each test, and the largest perentage accounted for by any one factor in any one test is 22 percent.

7. In view of conclusions 5 and 6, it seems that none of the tests of physical ability could be used to measure the factors of motor learning identified in this study. Likewise none of the tests of motor learning could be used to predict success in the tests of physical ability.

8. It appears that these factors of motor learning, if they are factors, are distinct factors. A distinct factor may be involved only in a specific part of the performance of an activity. For example, aiming control may be a specific part of the sport activity of pitching,

or throwing to a baseman. It seems possible that many such factors exist and that success in a sport or even a separate activity in a sport would depend on a certain combination of several such factors rather than on one factor alone.

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Specific Annoyances in Relation to Student Attitude in Physical Education Classes[1]

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INTRODUCTION AND REVIEW OF THE LITERATURE

COMPULSORY participation in physical education classes frequently results in some degree of resentment on the part of the students. While in extreme cases it may be exhibited by rebellion or other overt action, it may usually be expected to be milder in form, requiring special techniques for its observation. Certain individuals may have a general tendency to "gripe," or it may be that certain types of situations cause certain individuals to "gripe." This field has not been investigated very thoroughly, particularly in its relation to attitudes about physical education.

In reporting the results of an attitude study, Carr (4) has suggested that "if undesirable attitudes are obstacles to learning they should be removed." It would seem that the reason for an undesirable attitude must be uncovered before the problem can be handled properly. Poor attitudes might be expected to be particularly frequent in the case of required subjects and physical education is a required subject in the high schools of the State of California.

Baker (2) gave a questionnaire survey to 1150 girls and women between the ages of 15-25 and concluded from her results that "psycho-physical factors seemed to exert very slight influence on participation in physical education." She further concluded that attitudes in relation to physical activities were a reflection of the influence of outside factors.

Bullock and Alden (3) used a questionnaire with freshman college women which explored (a) early home life, (b) all phases of high school experience in physical education, including instructors, facilities, and programs, and (c) the same phases in relation to physical education work at the University of Oregon. Their conclusions were that in the case of required physical education, all factors causing distaste or a poor attitude "are of a nature that can

[1] From the Research Laboratory, department of physical education, University of California, Berkeley. The writer is indebted to Dr. Franklin M. Henry for advice and criticism during the course of this investigation.

be lessened, and in most cases entirely eliminated by improved methods and organizations in high schools and college."

Moore (15), taking a ten percent sampling of junior and senior women from each major department of a large college, used Form A of the Bues-Remmer scale (which is based on Thurstone's technique of rating a series of items) and followed this with an interview. She determined that "there was a highly favorable general attitude among college women toward physical activity as a means of recreation."

Carr (4), also using a questionnaire employing Thurstone's technique, covered the following three main areas: (a) social, (b) personal, and (c) activity. She found that the factors affecting success in physical education were (a) motor abilities, (b) attitudes, and (c) intelligence. Since motor ability and intelligence are more or less inherent qualities, she reasoned that "teachers should make themselves aware of students' attitudes" and try to remove reasons for undesirable reactions.

Nelson (13), using an eclectic type of personality questionnaire, found decided differences between ROTC and physical education high school students. The boys who took military instead of physical education had a less favorable attitude towards competition, games, and athletics.

Although Clevett (5) did some work on interests and their effect on participation of boys in voluntary physical education activities, such as recreational programs found in YMCA's, the present writer could find no studies that had attempted to determine whether or not behavior problems of boys in required programs (as exemplified by poor attitudes) are created by distasteful factors which are found within the physical education situation. From personal observation it was reasoned that if these factors were present, and if the physical educator could discover what they were, they might be reduced or eliminated, and thus physical education would become less of an obligation and more of a source of enjoyment and learning to a greater percentage of the group.

METHOD

According to Lundberg (12), the three general methods of studying attitudes are life-history documents, oral interviews, and questionnaires or rating tests. The first method represents "the crudest form of scientific social data" and was obviously unsuited to the present problem.

Oral interviews were used in studies by Kane and Hodson (10), and Moore (15) who used them in conjunction with a questionnaire. The writer interviewed 15 boys chosen at random from a class of high school juniors, and asked general questions about the physical education situation, i.e., program, facilities, and instructors. It was

soon realized that unless the boys were asked frequent leading questions or were prompted a great deal, little information could be obtained. Further problems which arose in attempting to use this technique were the time factor plus the lack of opportunity to conduct interviews under standard conditions.

It was therefore decided that the third method, represented by questionnaires and rating scales, offered the best possibility of obtaining information that (a) could be handled quantitatively, (b) could be obtained from large groups with a minimum of confusion, (c) would not take a prohibitive amount of the student's time, (d) could be given by an inexperienced investigator, and (e) would present a standard written interview under uniform conditions.

A large number of authors have done work on attitude scale construction (1, 11, 16, 17, 18, 19), but after an extensive study it was decided that Thurston's technique (18), previously mentioned, offered the most practical way in which the problem set forth could be attacked. Following this decision the writer set about compiling a list of statements which had reference to annoyances or irritations within the physical education situation. A study by Harsh (8) concerning annoyances proved to be of great value.

Of 373 items presented by Harsh (8), 188 were selected and the wording changed to point them toward a physical education situation. Twenty-five items were derived from the results of the 15 interviews during the preliminary work, and 35 more items were obtained from a study by Page (14) concerning factors influencing voluntary participation in physical education activities. This total of 248 items was then trimmed to 186 by the elimination of obvious duplications.

A preliminary validation of the questionnaire was accomplished by pooling the responses of five judges who were asked to select the items they thought would fit best in a questionnaire to test annoyances about the physical education situation.[2] Two of the judges teach physical education at the college level, two others teach physical education at the high school level, and the last judge was a graduate student in physical education who had additional background in psychology. The results showed 81 items having 100 percent agreement and 57 items having 80 percent agreement. In order to keep the questionnaire at a reasonable length, 17 of the latter group were discarded. The remaining 121 items were divided into 15 categories, utilizing Harsh's 13 categories of annoyances, plus "facilities and program" and "annoyances resulting from compulsion." The breakdown of these items according to category with an example of an item from each category are presented in Table I.[3]

[2] The writer is indebted to Dr. Franklin M. Henry, Dr. Frederick W. Cozens, Richard Christensen, Irwin Diamond, and Gaylord Nelson for the time and effort spent on these ratings.

[3] A copy of the questionnaire may be secured from the writer on request.

TABLE I

BREAKDOWN OF ITEMS ACCORDING TO CATEGORY

Category	*Example*	*Item Number*
I. Sensory annoyances: unesthetic sounds, feels and odors	To smell the odor of tobacco on the breath of a coach	1,16,30,43,55
II. Human anatomical or physical features	To play in a game with a very fat boy	9,24
III. One's own acts	Through carelessness, to make a misplay in a game	2,17,31,44
IV. Chance mishaps or occurrences affecting oneself or one's belongings	To have it start to rain during the gym period	10,25,38,50,61,71,80,88,93,99
V. Behavior pertaining to sanitary habits or untidiness in others	To see someone spit on the gym floor or an outside court	3,18,32,45,56,66,75,84,91,96, 102,107,113,116,119,120
VI. Inconsiderateness in others	To have a person crowd in line ahead of me	11,26,39,51,62,72,81,89,94,100, 105,109,112,115,118
VII. Behavior pertaining to etiquette	To hear the coach swear	4,19,33
VIII. Matters of dress and personal adornment	To see a coach who needs a shave	12
IX. Behavior directed especially toward oneself or one's belongings	To have my anatomical features criticized before others	5,20,34,46,57,67,76,85,97,103, 108,111,114,117,121
X. Eccentricities or mannerisms of others	To have a coach who is partial to the athletes in the class	13,27,40,52,63
XI. Demonstrativeness or pretenses of others	To see a boy with a good build showing off	6,21,35,47,58,68,77
XII. Behavior having a sexual association	To have someone stare at me in the shower or while I am drying	14,28,41,53,64,73,82
XIII. Behavior involving the inferiority, lack of self-control, or misfortune of others	To play in a game in which someone has lost his temper	7,22,36,48,59,69,78,86,92,98, 104
XIV. Program or facilities	To have to shift from activity to activity every day	15,29,42,54,65,74,83,90,95,101, 106,110
XV. Regimentation or compulsion	To be made to take gym when I don't feel like it	8,23,37,49,60,70,79,87

In setting up the questionnaire in its final form, one item was selected from each of the even categories, then one from each of the odd categories, etc., until all 121 of the items had been included. This was done to reduce the possibility of recognition of similar items as belonging to some particular category.

It next became necessary to decide upon a simple rating scale which could be easily handled by high school boys and would allow for the expression of the degree of annoyance. The following statement appeared on the questionnaire:

Write 1,2,3,4,5,6,7,8,9, or 10 depending on how you feel in each case. Remember that the highest number represents the strongest annoyance and the lowest number the least annoyance. Use the following scale as a guide to show your degree of annoyance.

1 2	3 4	5 6	7 8	9 10
doesn't annoy me at all	annoys me a little	annoys me pretty much	annoys me very much	annoys me very, very much

The 10-point scale, which is somewhat larger than is generally used in this type of study, was selected because it seemed desirable to keep the ratio of the standard error of grouping to the standard error of random sampling close to .10, as suggested by Jarrett in an article on permissible coarseness of grouping (10). Actually the 10-point scale had too few categories to reach this objective with the number of subjects tested. The calculated ratio turned out to be .165.

It then became desirable to set up a device by which the instructors could rate their students as to attitude. This was necessary in order that there would be some means of differentiating the good from the poor attitude groups. Each instructor was presented with an instruction sheet as follows:

This is an attempt to get a rating of your students' attitudes in the physical education class. Try as much as possible to overlook all other factors and rate the boys on this factor only. Athletic ability or physical capacity may influence attitude, but under the present rating it becomes possible for the good athlete to be found in the lower half of the scale, while the mediocre physical education student may be found near the top.

The table below will serve as a guide in helping you with the ratings.

1 2	3 4	5 6	7 8	9 10
very good attitude	good attitude	fair attitude	poor attitude	very poor attitude

After a short discussion, during which no hint as to how many good- or poor-attitude students were expected, each instructor was asked to go ahead on his own.

The questionnaire was then administered to a group consisting of 323 junior and senior boys in a large semi-rural high school. All of the juniors and seniors take their physical education in three pe-

riods during the day, so it was necessary to test the three groups separately.

The instructions preceding the questionnaire were read aloud to each group and all questions were answered before the boys began to mark their papers. No help which might alter an opinion was given at any time. The boys were instructed to work as individuals and were urged to express themselves freely. They were told that their instructors would not see their responses. The instructors' ratings were transferred to the first page of the questionnaire by the investigator. At no time did the instructors have access to a completed questionnaire. Some time later, each instructor was interviewed separately and asked to give his definition of attitude, plus other questions related to this study. It should be noted that the writer felt that individual differences in the judges' backgrounds, i.e., age, education, experience, etc., might influence the final outcome.

SUMMARY OF INTERVIEWS WITH THE FOUR INSTRUCTORS

General questions asked during the course of the interview

What is your definition of attitude? Upon what basis did you rate your students? Do certain things about boys annoy you, e.g., traits, habits, etc.? Do you emphasize your annoyances of these things to your class? Do you ever comment on the cleanliness of the physical education plant or equipment to the class or a group?

Reports of Interviews

Instructor A.—His definition of attitude includes such things as cooperation and active participation in gymnasium classes. His basis for rating his students was primarily their response to the activities they were asked to engage in. The type of thing that annoys this instructor most about boys is a type of conduct known as "gold bricking" (this seems to include a general over-all laziness and a lack of interest in physical education activities). He made the statement that he comments to individuals and to his teams about this type of conduct from time to time. This instructor was quite emphatic when it came to talking about cleanliness. He says that he comments on how good the facilities and equipment are and that boys are called in for talks about spitting on the floor, in drinking fountains, etc. He says he talks more about these items than anything else.

Instructor B.—His definition of attitude and his basis for rating the boys were the same, and include cooperation, how they follow through on directions, how they participate in games assigned, etc. Laziness, "gold bricking," spitting on the floor, swearing, and general moral dirtiness annoys him the most. He comments on these things to the individuals involved. He says that he passes out constant reminders with regard to keeping the gymnasium clean, not throwing

papers around in the bleachers, on the gymnasium floor, and in the locker room.

Instructor C.—This instructor's definition of attitude and his basis for rating his students were the same as the others, namely how the boys react to requests and how they enter into the program. He commented that insolence, disrespect, show-offs and general complainers annoy him the most. He talks both to individuals and to groups continually about the need for respect. He commends the boys for cleanliness if that is the condition that exists in the gymnasium and gets after them for poor "housekeeping" if the gymnasium is dirty. He also penalizes for throwing paper bags, towels, etc. He also mentioned getting after the janitor for more cleanliness.

Instructor D.—This instructor's definition of (good) attitude included "don't give excuses but are enthusiastic" and also how boys respond to requests of all kinds. His basis of rating was "whether or not they are show-offs or play the game for itself," and also general obedience to the rules. The thing that annoys this instructor most is loudness coupled with vulgarity (not necessarily obscenity). He mentioned that he does not emphasize his feelings about the above annoyance but that he does comment on the cleanliness situation.

DATA

The statistical method used to determine whether or not any of the items were answered differently by the "good" attitude students as compared with the "poor" attitude students was the Chi square test with Yates' correction for continuity (7). The groups were split at approximately the 50 percent point in each variable to form 2-x-2 contingency tables.

Calculation of the Chi squares for all four of the instructors combined resulted in a number of statistically differentiating items (see Table II). Since instructor C was more lenient in his rating, had been in the school longer, and had his physical education preparation in another state, it was felt that he hight have a different approach to the daily problems which may arise in teaching physical education. For this reason Chi squares were also calculated for the combination of the other three instructors only. Although this reduced the number of cases by 27 percent, there was a slight gain in the number of differentiating items. The Chi squares calculated for instructor C separately showed no more differentiating items than would be expected by chance.

An examination of the backgrounds of the remaining three instructors showed that Instructors A and B were approximately the same age, had been trained at the same university, and were both in their first year of teaching. Instructor D, however, was only a part-time physical education teacher, was several years older, and

TABLE II

TABLE II

CHI-SQUARES FOR SIGNIFICANT ITEMS BY CATEGORIES

Item No.	*Item*	*4 Instructors Comb. (A,B,C,D)*	*3 Instructors Comb. (A,B,D)*	*2 Instructors Comb. (A,B)*
Category I:				
16	To smell the odor of tobacco on the breath of a student	9.36	5.75	7.89
36	To be in the presence of a boy who is swearing while playing	...	3.53	6.10
33	To hear the coach swear	...	...	5.10
107	To see a boy or coach with tobacco stains on his fingers	3.25	4.24	4.89
1	To smell the odor of tobacco on the breath of a coach	...	...	4.14
64	To see one or a group of the boys looking at obscene pictures or magazines in the locker room	4.07	...	...
48	To hear a boy continually making excuses for being late or tardy	...	...	3.13
103	To be accused of lying	...	...	...
Category II:				
74	To have to shower when there are too many boys in the shower room for the number of showers and the size of the room	8.83	7.06	8.37
27	To have the coach be very forgetful or absent-minded about posting scores, keeping records, etc.	...	4.67	4.77
65	To have to play basketball in the gym when there are too many boys on the court	3.51	3.69	3.60
Category III:				
110	To have to go outside for gym when it is cold or early in the morning	...	4.52	5.45
8	To be made to take gym when I don't feel like it	4.59	5.71	4.87
60	To have to obey the coach even when I don't want to	...	...	4.06
23	To be made to shower when I don't feel like it	...	...	3.28
Category IV:				
4	To have a boy spit water on me in the shower	11.02	10.46	7.70
3	To see dust or dirt on the floor and equipment in the gym	7.09	8.85	4.18
55	To have to sit on a toilet seat after a boy who I know is unsanitary	3.21	...	3.05
Category V:				
21	To see a boy with a good build showing off	4.64	3.96	...
95	To have the boys who are out for sports excused from gym	5.51	...	3.82
34	To have my anatomical features criticized before others	...	3.40	...

had received his professional preparation elsewhere. Combining the questionnaires of the two similar judges and eliminating the third again produced an appreciable gain in the number of significant items, although the number of cases was reduced. (Other things being equal, a reduction in the number of cases decreases the number of significant items).

DISCUSSION OF THE DATA

In the group involving the combined questionnaires of the two instructors containing 196 subjects or 61 percent of the total sampling there are 17 items that give Chi squares which are statistically significant above the 8 percent level of confidence. A breakdown of these items shows a total of eight items most annoying to those rated as having a good attitude, while the remaining nine items most annoy those rated as having a poor attitude.

Taking the good-attitude group first, two distinct categories present themselves. It should be noted that the categories here assigned are quite general and will not necessarily be the same as those presented by Harsh.

Category I includes items which represent annoyance with smelling the odor of tobacco on either a coach or a student, or even seeing tobacco stains on a student's or coach's fingers (items 1, 16, 107). This expressed annoyance may be implicitly a denial of participation in the act of smoking, which is classified by persons who are leaders in church and child welfare groups as poor conduct in the high school group. Also included in this category is an annoyance from hearing a coach or student swear (items 33, 36). This may also be an implicit denial of personal participation in this "socially frowned-on" act. The final item in this category (item 48) may be considered a form of denial of the idea that the members of this group are late or tardy frequently, or (more directly) that they have to continually make excuses for being late or tardy.

In the writer's opinion, expressing annoyance in seeing these behaviors in others may well be a form of "projection" of what these boys think is a desired type of behavior in themselves. The general impression which can be received from the tabulated response to Category I is one in which the respondents state, in effect, "I am a good boy and therefore I do not participate in such frowned-on activities as smoking and swearing, nor do I get into such a position that I must continually make excuses for being late to class." The reasons for the denial of these activities may be due to a combination of several factors including home training, possible church influence, and, more probably, influence of the group with which these boys associate. It should also be pointed out that at least one of the two instructors involved expressed his own annoyance at hearing boys swear; thus fewer boys who did would be found in this group.

Category II contains items 27, 65, and 74. These annoyances are of such a nature that they would tend to make physical education less enjoyable, at least to those boys who were interested in it. To have to play basketball under crowded conditions or to have a coach be forgetful of keeping records, posting scores, etc., or to have to shower under crowded conditions would be the type of thing which might be expected to annoy boys who are really getting into the spirit of the program.

In considering those items which most annoy the poor-attitude group, there appears to be three fairly distinct categories. Category III represents an apparent rebellion against compulsion by these boys. They are annoyed by being made to take "gym" when they don't feel like it (item 8), or take a shower when they don't feel like it (item 23), or to obey the coach when they don't feel like it (item 60). It is probable that most boys are subjected to these pressures at some time, but there is an apparent resistance to physical education among the poor-attitude group. It should be noted that both of the instructors involved in this group of significant items expressed dissatisfaction with the "gold bricking" attitude and thus they were probably inclined to be unsympathetic with boys who fitted into this group.

Category IV might well be labeled "gripes." Its items are characterized by a complaint about facilities as in item 3, "to see dust or dirt on the floor or equipment in the gym," or "to have to sit on a toilet seat after an unsanitary boy" (item 55). Item 4, "to have a boy spit water on me in the shower," was a particularly significant one (Chi square, 7.70). In a non-compulsory situation this juvenile practical joke might be taken in stride, but it is understandable that it might be highly annoying to the boys who are in the showers and subjected to this indignity as a part of the physical education situation in which they are participating against their will. Similarly, item 95 (Category V) being annoyed by seeing some of the other boys excused from physical education because they are "out for a sport," may indicate a degree of rebellion against the compulsory physical education requirement. Since any of these boys could have gone out for a sport, the response to this item probably indicates an implicit rejection of sports as well as of physical education.

The above discussion has had to do with the results obtained with the two similar judges. Table II has shown that the differentiating items give much the same picture when the combined results of three and of four instructors are used, although there is some reflection of the "diluting" influence of instructor C and the different background of instructor D. According to the null hypothesis, there is one chance in a hundred that a chi-square as high as 6.6 will occur due to sampling error. In this study, four items have this degree of significance, so the results are approximately 400 per-

cent better than chance. There are five chances in a hundred that a chi-square of 3.8 or higher will occur from sampling error. Even at this lower level of confidence there are twice as many significant chi-squares as would be expected by the null hypothesis.

SUMMARY AND CONCLUSIONS

One hundred and twenty-one items, representing annoyances to factors directly or indirectly related to physical education, were derived from (a) the Harsh study of "Categories of Annoyances," (b) the results of 15 interviews by the present writer in a preliminary study, and (c) the Page questionnaire on high school and college physical education participation. These items were presented to 323 junior and senior high school boys in a large semi-rural high school. The subjects expressed their degree of annoyance with respect to each item. These scores were related to a rating of the boy's over-all attitude toward physical education by each instructor.

The statistically differentiating items formed five general categories. Categories I and II (8 items) concerning "good-boy" responses, such as annoyance by smoking, swearing, tardiness, etc., included the items most annoying to the boys rated by the instructors as having a "good" attitude. The remaining three categories (9 items) having to do with rebellion against compulsion and various "gripes," included the items most annoying to the poor-attitude group.

It is concluded that:

1. There is a difference in the general types of things which annoy the group of boys to whom instructors independently assigned a rating of good attitude towards physical education and the group assigned a rating of poor attitude.

2. Boys who are in the good-attitude group are annoyed by items which might be expected to bother the "good-boy" type, while in the poor-attitude group there seems to be a suggestion of "rebellion" toward compulsory physical education.

3. While certain sources of annoyances could be removed (lack of cleanliness, inadequate facilities, etc.), most of them are of a nature that involve the personality or behavior of other students or instructors.

IMPLICATIONS

There is apparently a need to examine the compulsory physical education situation, with the thought of reducing individual resentment against the compulsory features. Possible ways of accomplishing this might include increasing the appeal of the program to the poor-attitude group by discovering and including activities that interest them and reducing to a practical minimum the specific factors that are objectionable. It should be realized that many specific annoyances may be only symptomatic and actually due to more deep-seated causes.

A further study suggested by this investigation would be an

examination of the relation of the personality of the instructors to the proportions of boys, in a definite situation, who show evidence of a like or dislike for physical education. Also a study similar to the present one could be done in a high school where there is extensive classification and organization of classes as to ability, thus allowing a greater number to experience success in physical education. There is also need for further work on the discovery of the features of the program and facilities which are related to justifiable resentment on the part of the poor-attitude group.

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Research Abstracts

GRANVILLE B. JOHNSON

ANATOMY

Siekert. R. G. An anomalous human heart: The left subclavian artery arising from a patent ductus arteriosus together with other defects. *Anat. Rec.*, 103:4 (April, 1949).

A rare case of congenital malformation of the heart, occurring in a 23-year old colored female, is described. It possessed a right-sided aorta, which, after arising from both ventricles by virtue of a large interventricular aperture, gave origin to the left and the right common carotid and the right subclavian arteries. The left subclavian artery arose from a large patent ductus arteriosus; this canal, joining the aorta behind the esophagus, formed, with the latter, a vascular collar around the contained trachea and esophagus, the aorta on the right and the ductus on the left.

The vein of the left atrium was patent and connected the left superior intercostal and hemiazygos veins with the coronary sinus.—*Wistar Institute.*

EDUCATION

Messich, J. D. Teaching and service loads of college and university staffs. *School and Society*, 69:1798:335-36 (May, 1949).

Questionnaires were sent to sixty-six colleges of arts and sciences and to universities and to twenty-eight teachers' colleges. All were members of the Southern Association of Colleges and Secondary Schools. There were fifty-five replies received. Twenty-seven colleges expect a load of fifteen hours of their teachers. Five colleges expect a total of forty-five hours, while one college expects from twelve to twenty hours as a load. Twenty-eight colleges try to keep balanced classes while twelve colleges reduce the teaching load when instructors have large classes. Thirty-five do not count extra-class activities as service loads. Twenty-one colleges had no policy set up relative to this question. Twenty-one of the fifty-five colleges reporting have nine-month service periods. Thirty stated that additional salary should not be paid for required extra service to the colleges.—*Carolyn Bookwalter.*

Salley, R. E., and R. G. Weinstraub. Student records of entrance and graduation. *School and Society*, 69:1798:404-06 (June, 1949).

Five hundred and eighty-nine college graduates for June, 1947, were investigated relative to school records. The American Council on Education tests had been given to the group upon entrance to college.

One graduate who was in the twentieth percentile on ACE was in the highest quartile of the graduates according to academic marks ranking. Three students who had received a score of 99 percent on ACE were found to be in the lowest quartile of the graduates.

One-third of the students majoring in art, home economics, political science, and pre-social were in the lowest quartile. One-third of the students majoring in English, French, mathematics, and history were in the highest quartile. There were twice as many students who had activity indices of six or better in the highest quartile as there were in the lowest quartile.—*Carolyn W. Bookwalter.*

Wheeler, L. R., and V. D. Wheeler. The relationship between reading ability and intelligence among university freshmen. *Journal of Educational Psychology,* 40:4:230-238 (April, 1949).

Records on the American Council on Education psychological ratings and on reading scores of 1,681 freshmen enrolled November, 1946, and February, 1947, at the University of Miami were compared. Liberal arts students were found to rank highest in reading skill. Education non-academic (physical education) majors ranked lowest. The physical education majors also ranked significantly below the teachers' college norm (C.R.—5.91).

On the ACE linguistic scores the physical education majors were lower than the liberal arts students (C.R.—13.40) and on the quantitative scores they were also lower (C.R.—5.00). On the gross scores the physical education majors differed from the liberal arts students by a C. R. of 7.20.

The authors concluded that the American Council on Education examination was materially influenced by reading efficiency. Special consideration should be given to this factor in using the test results.—*Carolyn W. Bookwalter.*

NUTRITION

Betheil, J. J., and H. A. Lardy. Comparative effectiveness of vitamin B_{12}, whole liver substance, and extracts high in APA activity, as growth-promoting materials for hyperthyroid animals. *J. Nutrition,* 27:4 (April, 1949).

It was found that vitamin B_{12} and liver extracts high in anti-pernicious anemia activity were markedly potent in promoting growth of the rat fed desiccated thyroid. Graded responses to liver extract were obtained when increasing amounts of the material were administered. APA concentrates markedly prolonged the survival of thyroxine-treated rabbits. Liver, as previously shown, tomatoes, and fish soluble components were also effective.

The incubation of folic acid with various sources of the "intrinsic" factor did not result in the formation of a nutritionally active material for the hyperthyroid rat. Formylfolic acid, skim milk, and fibrin were ineffective. Iodinated casein is a suitable agent for the production of experimental hyperthyroidism in the rat. The possible relationship of B_{12} and liver extract in the nutrition of the rat is indicated. Evidence of the dual nature of the factor or factors required by the hyperthyroid rat is presented.—*Wistar Institute.*

Garber, M., M. M. Marquette, and H. T. Parsons. The availability of vitamins from yeasts. V. Differences in the influence of live yeast on the absorption of pure thiamine hydrochloride, pure riboflavin and nitrogen by human subjects and the effect of distribution of vitamin doses. *J. Nutrition,* 38:2 (June, 1949).

A higher percentage of a dose of thiamine hydrochloride was returned in the urine of human subjects when the supplement was ingested with meals rather than between meals. The urinary return of riboflavin was not similarly influenced. Pure thiamine hydrochloride ingested with fresh bakers' yeast failed to be returned in the urine, presumably through almost complete failure of absorption by the digestive tract. This was the same effect as that observed previously in respect to food thiamine ingested with live yeast. Hence, the "interference" by fresh yeast is not attributable per se to the effect of an anti-enzyme in the digestive tract. In the same experiment live yeast interfered less with riboflavin than with thiamine in that only the riboflavin of the live yeast cell, not that in the food or in pure form, appeared to be withheld from absorption; nitrogen was least affected, inasmuch as an average of 80 percent of the nitrogen of the yeast cell itself was returned in the urine. That these differences in excretion were actually due to differences in absorption tended to

be borne out by fecal assays. These observations make necessary some further elaboration of the hypothesis that food thiamine is interfered with by live yeast because of competition between the absorbing membranes of the live yeast cell and of the digestive tract, with a resulting retention of the absorbed thiamine within the yeast cell.—*Wistar Institute.*

Papageorge, E. T., and G. L. Mitchell, Jr. The effect of oral administration of rutin on blood, liver, and adrenal ascorbic acid and on liver and adrenal cholesterol in guinea pigs. *J. Nutrition,* 37:4 (April, 1949).

Three groups of 16 young, adult, male guinea pigs each, were maintained respectively on the following daily intakes of ascorbic acid expressed as milligrams per 100 gm of body weight: 1.8, 1.57, and 0.40. Eight animals in each group served as controls and eight were given 20 mg of rutin orally every other day during the test period. The animals on the 1.8 mg intake and those on the 0.4 mg intake were sacrificed on the 22nd day and analyses were made for whole blood, liver, and adrenal ascorbic acid (total), and for liver and adrenal cholesterol (total). The animals on the 1.57 mg intake were sacrificed on the 15th day and only blood and adrenal vitamin C were determined. No significant effect of rutin was found on blood and liver ascorbic acid or on liver and adrenal cholesterol regardless of the level of vitamin intake. Nor was any effect shown on adrenal ascorbic acid in the animals on the inadequate vitamin intake. However, the mean values for adrenal ascorbic acid of the rutin-fed animals maintained on the 1.8 mg and 1.6 mg intakes were, respectively, 19.9 percent and 34.6 percent higher than those of the corresponding controls.—*Wistar Institute.*

Schor, H. C., and H. L. Swain. Simultaneous surveys of food consumption in various camps of the United States Army. *J. Nutrition,* 38:1 (May, 1949).

Simultaneous nutrition surveys were carried out in May, 1945, at 44 military posts of the United States Army where Field Ration A, the rough equivalent of a liberal civilian diet in which there is a wide range of food, was provided. The food consumption levels reported indicated that, judged by National Research Council standards, the American soldier in the Zone of Interior received a nutritionally adequate diet, although mass operations could have been improved through continued education and supervision of mess personnel. In the mess the average caloric intake of the average soldier per day, as determined by evaluation of food consumed, was approximately 3,700 Cal., fortified by an additional 300 to 400 Cal. consumed per day by virtue of food purchases at the post exchange. Food wastage comprised an average of 0.24 lb. of edible food per man per day. No significant correlations were found between the consumption of any individual nutrient and local mean temperature, altitude, or the activity of the group.—*Wistar Institute.*

Sherman, H. C., and H. Y. Trupp. Long-term experiments at or near the optimal level of intake of vitamin A. *J. Nutrition,* 37:4 (April, 1949).

Wheat-and-milk food mixtures otherwise alike but differently enriched with high-grade cod liver oil so as to contain respectively 12 I. U. and 24 I. U. of vitamin A per gram of air-dried food, were fed to parallel lots of rats, in all 24 males and 36 females on each diet. Growth, breeding records, and lengths of life were normal and essentially similar on these two diets. With both sexes, bodily storage of vitamin A increased with the level of intake and was higher at 700 than at 500 days of age, indicating that ability to store this vitamin continues through middle life. By comparison of the data of these experiments with those at lower levels of vitamin A intake previously reported from this laboratory, it appears that for best long-term results about 4 times as much vitamin A is required as for minimum adequacy, and that such quad-

rupling of the intake of vitamin A increases the length of normal life by about 10 percent in males and 12 percent in females.—*Wistar Institute.*

Swain, H. L., F. M. Toth, and F. C. Consolazio, W. H. Fitzpatrick, D. I. Allen, and C. J. Koehm, Jr. Food consumption of soldiers in a subarctic climate (Fort Churchill, Manitoba, Canada, 1947-1948). *J. Nutrition,* 38:1 (May, 1949).

A study was made of the voluntary food consumption of garrison troops in a subarctic climate at Fort Churchill, Manitoba, Canada, during 10-day periods in November, 1947, February, 1948, and April, 1948. The average daily consumption per man in the three surveys was 5,620, 5,990, and 5,690 Cal., respectively. The troops remained in good health and maintained their body weights. The caloric intake in each survey was inversely correlated with the mean temperature prevailing at the time of the survey; that is, the colder the weather the more calories were consumed. In all three surveys the percentage of calories furnished by protein fat and carbohydrate remained almost constant, averaging 13, 41, and 46, respectively. These values are not significantly different from those reported many times for garrison troops in temperate climates. As judged by consumption of individual food items, the pattern of food habits was not different in Fort Churchill and in U. S. Army camps in temperate climates.—*Wistar Institute.*

PHYSIOLOGY

Eichna, I. W. Thermal gradients during varying body temperatures. *Arch. Physic. Med.,* 29:687-697 (1948).

When the skin was cooled either by the application of ice, or by repeated applications of water with subsequent fanning, there was a prompt fall of the skin and subcutaneous temperatures, but little if any effect upon the rectal temperature. Immediately upon discontinuation of cooling, rectal temperature decreased. This phenomenon is probably due to cutaneous vasoconstriction during the period of the active cooling and a subsequent vasodilation.—*Peter V. Karpovich.*

Kosman, A. J., S. I. Osborne, and D. C. Ivy. Importance of current form and frequency in electrical stimulation of muscles. *Arch. Physic. Med.,* 29:559-562 (1948).

A group of 23 dogs with bilateral section of the sciatic nerve was used. The gastrocnemius-soleus muscles of one limb were treated twice daily for 5 minutes with a modulated sinusoidal current with a carrier frequency of 25 cycles per second. The intensity of the current was adjusted so as not to cause discomfort. The animals were sacrificed at 3, 6, and 9 months after denervation and the weights of the muscles were determined. The weight of the untreated muscles at the end of the nine-month period was about one-half that of the treated ones.—*Peter V. Karpovich.*

Kosman, A. J., E. C. Wood, and S. I. Osborne. The effect of massage upon the denervated skeletal muscle of the dog. *Arch. Physic. Med.,* 29:8:489-490 (1948).

Experiment was made on 14 dogs with bilateral section of the sciatic nerve. Daily 10-minute massage was applied to one denervated limb, the other serving as a control. The animals were killed at intervals of 2 to 8 months and the weights and strengths of the muscles (tibialis) were determined. No difference between treated and untreated muscles was observed.—*Peter V. Karpovich.*

Siems, I. I., A. J. Kosman, and S. I. Osborne. A comparative study of short wave and microwave diathermy on blood flow.—*Arch. Physic. Med.*, 29:12:759-764 (1948).

The blood flow in the femoral arteries of dogs was measured during short wave and microwave diathermy of the legs. Both methods proved to be equally effective in increasing the blood flow. The loss of motor or sensory innervation did not essentially change the vascular response. The integrity of the sympathetic system was found to be necessary for a normal response.—*Peter V. Karpovich.*

Taylor, C. M., O. F. Pye, A. B. Caldwell, and E. R. Sostman. The energy expenditure of boys and girls 9 to 11 years of age: (1) Sitting listening to the radio (phonograph), (2) sitting singing, and (3) standing singing. *J. Nutrition*, 38:1 (May, 1949).

Using a respiration chamber, the energy expenditure of 12 boys and 10 girls sitting listening to the radio (phonograph), of 6 boys and 9 girls sitting singing, and of 8 boys and 9 girls standing singing was determined. While sitting listening to the radio (phonograph), the average energy expenditure of the boys was 2.07 Cal. per kilogram of body weight per hour or 0.54 Cal. per centimeter of height per hour (44 and 46 percent, respectively, above their average basal metabolism). The average for the girls was 1.80 Cal. per kilogram per hour or 0.45 Cal. per centimeter per hour (20 and 25 percent, respectively, above their average basal metabolism). Sitting singing the boys expended 2.23 Cal. per kilogram per hour or 0.57 Cal. per centimeter per hour (53 and 50 percent, respectively, above their average basal metabolism). The girls averaged 2.06 Cal. per kilogram per hour or 0.52 Cal. per centimeter per hour (41 and 44 percent, respectively, above their average basal metabolism).

Standing singing the boys expended 2.35 Cal. per kilogram per hour or 0.60 Cal. per centimeter per hour (58 and 62 percent, respectively, above their average basal metabolism), while the girls averaged 2.13 Cal. per kilogram per hour or 0.54 Cal. per centimeter per hour (46 and 50 percent, respectively, above their average basal metabolism).—*Wistar Institute.*

Terrier, J. C., K. G. Wakim, and F. H. Krusen. The effect of occlusion with various pressures on the blood flow in the lower extremities. *Arch. Physic. Med.*, 29:7:391-395 (1948).

Blood flow was measured by means of plethysmographs (foot and lower leg). Occlusion was affected by pneumatic cuffs placed just above the plethysmographs. Neither a five-minute occlusion nor an intermittent occlusion for one hour had any significant effect. Normal and arteriosclerotic patients were used.—*Peter V. Karpovich.*

PSYCHOLOGY

Kimble, G. A., and B. R. Horenstein. Reminiscence in motor learning as a function of length of interpolated rest. *Journal of Experimental Psychology*, 38:239-244 (1948).

Six groups of male Ss were given ten 50-second trials, with a 10-second inter-trial interval on a modified Koerth pursuit rotor. After rests of 10, 30, 150, 300, 600, or 1,200 seconds, two 50-second reminiscence trials were given, with the end in view of investigating the relationship between the amount of reminiscence and the length of interpolated rest interval.

The results indicate that reminiscence increases as a negatively accelerated function of length of rest and is very close to the asymptote at 600 seconds, beyond which longer rests appear to be ineffective in producing greater reminiscence.

By inverting the recovery function, a measure of decay of I_R was calculated,

and a simple negative growth function was fitted to the points thus obtained.

The results of the investigation seem to verify Hull's theoretical formulation of the decay of inhibition as a function of time.—*Franklin Henry.*

Davis, R. C. Motor effects of strong auditory stimuli. *Journal of Experimental Psychology,* 38:257-275 (1948).

Cathode ray oscilloscopes were used to record the muscle-action potentials in the forearms resulting from the stimulus of a loud sound, the subject being instructed to do nothing in response to the sound. Two types of responses were found: (a) the *a* type, with a latency of 0.1 second and a duration of 0.5 second, showing marked and rapid adaptation, probably present only when the sound intensity is higher than 90 db at 500 cycles; (b) the *b* type, of undetermined latency, reaching a maximum at about one second and lasting two seconds before declining, showing no adaptation and uninfluenced by stimulus intensity with a wide range.

Both types of response are related to the pre-stimulus degree of tension. There is facilitation by ipsilateral tension and slight inhibition by contralateral tension.—*Franklin Henry.*

Henry, F. M. Discrimination of the duration of a sound. *Journal of Experimental Psychology,* 38:734-743 (1948).

A difference of 14 to 20 percent in the duration of an auditory signal of medium intensity and pitch (50 db. at 500 cycles) is necessary for the difference to be perceived, when the length of the signal lies between approximately .05 and .5 seconds. A much larger difference is required if the signal is very short, very weak, or low in pitch, but higher intensities and pitches fail to give better perception of the duration of the signal. The results are shown to be consistent with a theory that presumes that the intensity-duration product (i.e., integrated intensity) is the basic perceptual unit, and that intensity and duration are equivalent for sounds that are shorter than a half-second.—*Franklin Henry.*

Wickens, D. D. Stimulus identity as related to response specificity and response generalization. *Journal of Experimental Psychology,* 38:389-394 (1948).

Two groups of subjects were conditioned to respond to the sounding of a tone by making an extensor movement of the finger. The hand was then turned over so that the appropriate withdrawal movement would be flexion. One group of twenty-seven was then tested for conditioned responses with the original tone, and twenty-one out of twenty-five responding used the new appropriate movement. The other group of thirty-two was tested with a different tone, one or more octaves displaced from the original sound. Of the twenty-two subjects giving conditioned responses, all were of the new appropriate type. Thus there is evidence of a trend for response generalization as well as stimulus generalization. The *act* rather than the *specific movement* became attached to the stimulus.—*Franklin Henry.*

Gebhard, Mildred E. The effect of success and failure upon the attractiveness of activities as a function of experience, expectation, and need. *Journal of Experimental Psychology,* 38:371-388 (1948).

Each of eighty women college students ranked nine tasks (arithmetic, codes, cube counting, sentence completion, form board, number checking, sentence matching, symbol transcription, and algebraic reasoning) as to attractiveness, did the task that was individually ranked median, and then re-ranked the tasks. Using a plan of balanced factorial design, half of the subjects were told the experiment concerned relationships between interest and aptitude and measured general intelligence, while half were told it concerned reaction to the nature of the task and the quality of performance was unimportant. Through com-

ments of the experimenter and comparison with fictitious norms, half were given reason to experience success and half, failure; also half were given reason to believe the task was very easy and half that it was extremely difficult.

The experimental results show that changes in task-attractiveness depend on the *experience* of success or failure as well as *expectation* of success or failure. Experience plus expectation of success (or of failure) result in greater change in attractiveness, whereas the experience of success coupled with the expectation of failure (or the converse) results in a smaller change. Personal interest and general comments are more favorable and of greater magnitude with experienced or expected success than with failure. The attractiveness of an activity is determined not only by past experience of success or failure, but also by expectation of future success or failure.—*Franklin Henry.*

Asch, S. E., and H. A. Witkin. Studies in space orientation. II: Perception of the upright with displaced visual fields and with body tilted. *Journal of Experimental Psychology,* 38:455-477 (1948).

To overcome certain disadvantages of the tilted-mirror situation as a technique for separating visual and postural determinants of the perceived upright, a new procedure was developed. The S was presented with a small tilted room, on the back wall of which was a rod which he had to adjust to the true upright. In a first test, judgments of the rod were obtained with body upright, and under three different conditions of the field: (a) the S, standing at a distance from the tilted scene, viewed it through a tube which restricted his view to the interior of the scene; (b) the S stood directly in front of the scene without a tube; (c) the S stood at a distance from the scene, without a tube, so that he saw not only the tilted scene but the outer upright room as well. Under all three conditions the perceived vertical and horizontal were displaced significantly in the direction of the axes of the tilted scene. When an outer upright field was present, as in the third condition, the effect of the tilted scene upon the perceived upright diminished. In another experiment, judgments of the rod were obtained with body tilted, both to the same side as the field and to the opposite side. It was found that tilting the body resulted in an increased tendency to accept the tilted field as a basis for judging the upright. Not only were the perceived vertical and horizontal displaced further in the direction of the tilted scene, but a number of Ss perceived the tilted scene as fully upright. In another experiment there was found a tendency for the tilted scene to right itself with prolonged observation. In some cases the righting was complete, so that at the end of the observation period, the tilted scene was perceived to be fully upright. Under all conditions, striking individual differences were found in the extent to which the perceived upright was affected by the surrounding tilted field. There is evidence of considerable consistency in a person's performance under the different conditions employed.—*Franklin Henry.*

SOCIOLOGY

Landis, Paul H. Personality differences of girls from farm, town, and city. *Rural Sociology,* 14:1:10-20 (March, 1949).

Records of 482 girls from Washington State College were studied relative to their scores on three standard social and emotional adjustment rating scales, and the scores on the American Council on Education psychological examination. Retiring traits in greater proportion were found in the girls reared in farm areas. The farm girls were also found to be less given to persuasiveness. The farm girls were found to be more practical while the city girl was found to be more aesthetic. Sorority girls were found to be aggressive, especially farm girls. They were also found to have a slightly higher emotional adjustment rating. The larger the areas of residence and the higher the parental education, the better the adjustment of the girl.—*Carolyn W. Bookwalter.*

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Since three members of the Board of Associate Editors review an article it is requested that at least two copies of the manuscript (the original and a clear carbon) be submitted in order to facilitate reviewing. One copy of the article should be retained by the author for checking against galley proofs. Manuscripts should be double spaced.

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Ogden, Jean, and Jess Ogden. *Small Communities in Action.* New York City: Harper & Brothers, 1946. (books)

Deaver, G. G. Exercise and heart disease. *Research Quarterly,* 10:24-34, 1939. (periodicals)

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Mississippi (1): (No report).
North Carolina (2): (No report).
Oklahoma (2): Paul Alyea; (One to be selected).
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